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This publication is a revised edition of the teachers guide for teaching soil and water conservation in the elementary and junior high schools of Louisiana. The format of the guide includes a statement of concept, followed by discussion of the concept, suggested activities, and possible outcomes. There is a glossary of terms and a section that includes a brief description of the major land resource areas in Louisiana. The concepts included, in their suggested teaching sequence, are: the importance of soil as a resource, the formation and make-up of soil, types of soil, soil losses and deterioration, the essential nature of water, water as a renewable source, floods, pollution, water as a source of recreation, and conservation of soil and water. (BR)

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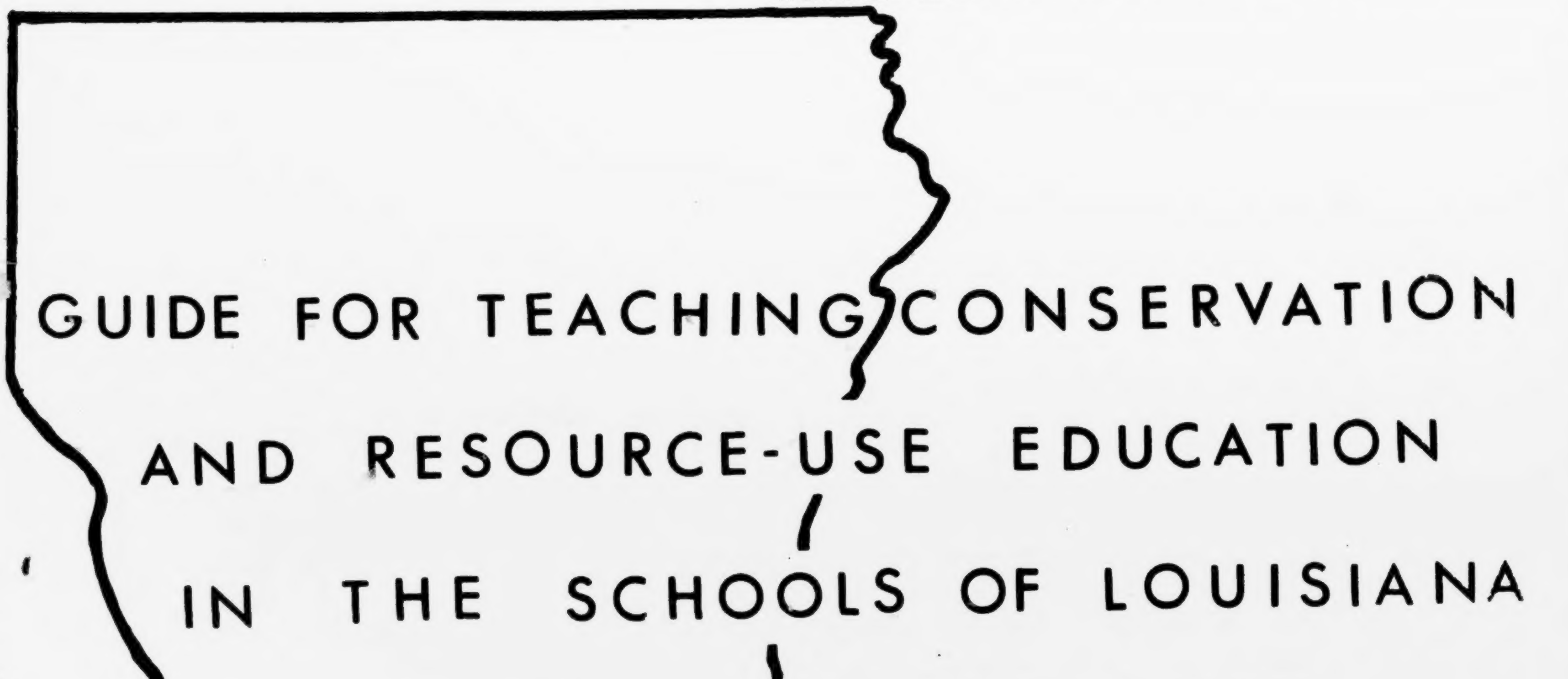

A GUIDE FOR TEACHING CONSERVATION AND RESOURCE-USE EDUCATION IN THE SCHOOLS OF LOUISIANA

SOILS AND WATER

OUR SOIL ★ OUR STRENGTH

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U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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A GUIDE FOR TEACHING CONSERVATION EDUCATION IN THE SCHOOLS OF LOUISIANA

SOIL AND WATER SECTION

Prepared originally by a committee of teachers

under the direction of

Dr. George Ware

and

Howard P. McCollum

and

Issued by the
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Baton Rouge, Louisiana
1962

Revised by the

NORTH LOUISIANA SUPPLEMENTARY EDUCATION CENTER

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1968

STATE OF LOUISIANA
DEPARTMENT OF EDUCATION
BATON ROUGE 4

WILLIAM J. DODD
STATE SUPERINTENDENT

To the Teachers and School Officials of Louisiana

Greetings:

If one accepts the modern school as an effective institution for the attainment of improved living, then a consideration of the conservation of natural resources as one phase of the school program is no longer debatable. The importance of the problems connected with the wise use of natural resources and their broad implications for the welfare of our people leave the school no alternative.

Our place as a nation has been established because our people have had the energy and skill to develop and use our abundant supply of natural resources. So abundant were these resources when first discovered that they were looked upon as being limitless and inexhaustible. The face of this nation has been changed through the years by those who have thoughtlessly wasted wildlife of all sorts, large areas of fertile land, and vital water supplies. In the past, industry has been draining our valuable mineral resources and changing the ecology of our streams and forests. The carelessness of past generations is now apparent; the lack of prescience resulted in the destruction of our lavishly plentiful natural resources. Our resources will last only if we accept the obligations of our stewardship. We should use rationally, build up, and distribute equitably in terms of public benefit, what we call the natural resources of the country. This is conservation.

Sincerely yours,

William J. Dodd
State Superintendent

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Post Office Box 1630
Alexandria, Louisiana 71301

January 29, 1968

To Teachers and School Officials of Louisiana:

At no time in our Nation's history have so many people depended so greatly on our natural resources. Of these, soil and water are basic and the foundation for all living things.

We are living at a time when the message of soil and water conservation must be conveyed to all people - not only to farmers but to doctors, lawyers, businessmen, teachers, and young people as well. It is a message for every man, woman, and child. Soil and water conservation is everybody's business. If we eat food - drink water - wear clothes, and live in a house, then we need to be aware of the problems around us, and concerned about the care of our land and water resources.

About one-half of Louisiana's population is 19 years old or younger. This means that teachers in Louisiana, and America, are burdened with the vast responsibility of cultivating young minds. The classroom is the only place where many students learn about soil and water and the part they play in everyday life.

Many new opportunities are paving the way for teaching conservation in Louisiana schools. One is the formation of the North Louisiana Supplementary Education Center. The Center, in cooperation with the State Department of Education and other State and Federal agencies, is conducting teacher workshops in resource conservation and is making successful efforts to create a renewed awareness in the appreciation of soil and water and other natural resources. The bringing together of these concepts and guides is still another effort to facilitate the teaching job.

I hope this material will play an important role to help teach our youth why we must safeguard and conserve soil and water for a prosperous community and a strong America.

This knowledge could very well hold the key to our future. Also, I hope you will call on your soil and water conservation district and the Soil Conservation Service anytime we can be of help to you.

JB Earle

J. B. Earle,
State Conservationist

Foreword

In the summer of 1962 there were prepared four Guides for Teaching Conservation and Resource-Use in the Schools of Louisiana. This was done by committees of teachers under the direction of Dr. George Ware and this writer. The teachers involved in the effort that produced this particular Guide were Misses Margaret S. Amrhein, and Clarice M. Berlin, Mesdames Maggie H. Bryan, Iona Gartman, Pauline M. Jones, Reba H. Parrott, and Glenice M. Woods, and Mr. Olian O. Warner. These Guides were published by the State Department of Education and distributed to a limited number of teachers for trial use. They dealt separately with Forests, Wildlife, Soil and Water, and Minerals, and were covered by the State Department's blanket copyright for such materials.

When the North Louisiana Supplementary Education Center was established in the summer of 1967, Superintendent W. J. Dodd granted to this organization permission to revise these Guides to bring them up to date and, hopefully, to make them more useful to teachers and school officials to the end of improving the conservation education being carried on in the schools of the State. This bulletin is the second of the four revisions. The other two will follow as rapidly as possible.

The revision was made by the Conservation Education Division of the Center. It is still considered tentative, and all teachers and school officials who use it are urged to submit to the Center any and all their suggestions for improving it in such ways as may be found to increase its usefulness.

The Conservation Education Division of the Center acknowledges its indebtedness to members of the State Department staff, Dr. Stan Shaw and Mr. Jack Ensminger, and to Messrs. Gene Warren and David Slusher of the U.S. Soil Conservation Service for their valuable assistance in the task.

Howard P. McCollum, Director
North Louisiana Supplementary Education Center

Natchitoches, Louisiana
January, 1968

PHILOSOPHY

Conservation is an attitude; it should become a way of life. Beginning emphasis is upon a problem-solving approach to the wise use of materials in the school and home communities. Children should learn the fundamental importance of soil and water, why they are so closely associated, and how they are basic to all other living resources, to the economy of our state and nation, and to the very continued existence of man. They should also be led to understand thoroughly that the conservation of soil and water is vital to us as individuals, to our state, and to our nation.

Conservation is one part of the total instructional program. Accumulating information is basic to the development of desirable understandings, appreciations, and attitudes toward the use of our natural resources. Conservation education, therefore, includes reading, writing, observing, reporting, and listening. Conservation can become more realistic and meaningful through doing in which everyone participates in school and community projects.

TO THE TEACHER

This GUIDE is a revision of the one you have been using for help in teaching soil and water conservation. This is the second such revision of a GUIDE. You have already received the revised work on Forest Conservation. The revisions of those on Wildlife and Minerals will follow as rapidly as they can be effected.

To give continuity to the progressive teaching of soil and water conservation through the junior-high-school grades, the concepts have been arranged in the same sequence for all three levels--primary, intermediate, and junior high. The sequence is as follows:

1. The importance of soil as a resource
2. The formation and make-up of soil
3. Types of soils
4. Soil losses and deterioration
5. The essential nature of water
6. Water as a renewable resource
7. Floods
8. Pollution
9. Water as a source of recreation
10. Conservation of soil and water.

The concepts are differently stated at the three levels, but the general idea of each is the same as the list above.

To accompany this revised GUIDE, there is being prepared, as a separate bulletin, a bibliography of free and inexpensive materials that are useful in teaching the conservation of soil and water. You should receive both publications at the same time.

This GUIDE is prepared for the teacher's and school officials' use only. The "discussions" that follow the statements of the concepts have been prepared to provide the teacher with a brief overview of the inclusiveness of the concept and the extent to which it should be limited for the children at the different levels. The "suggested activities" are really just suggested. No teacher should feel obligated to carry out all of them, nor should any teacher feel that any of his or her own ideas for learning activities are in any way precluded by them. It is hoped that every teacher will understand that it is expected that many will need adaptation to local conditions. The "possible outcomes" are included as mere suggestions of overall objectives that might be realized from study of a particular concept. They should not be considered as exhausting such possibilities.

This revision should be considered tentative, and each person using it can contribute to its improvement for final form by suggesting additional appropriate activities, achievable outcomes, or any needed changes that will make it more useful. Your help is earnestly solicited.

PRIMARY

1. CONCEPT: MAN GETS FOOD, CLOTHING, AND SHELTER FROM THE SOIL.

Discussion: It is felt that the earliest approach to soil conservation should be an attempt to get children to realize that soil is important. In fact, it is fundamental to all our other resources. So it is essential that children recognize the importance of soil to man--how man depends upon the soil, and how the soil rewards man when he uses it wisely.

It should be relatively easy for primary children to perceive the importance of soil when they learn that man gets his food, clothing, and shelter from that source. Foods directly produced from plants that grow in the soil should be the first to be listed. These include vegetables, fruits, and seeds that are included in our regular diets. Meats, eggs, and milk products are only one step removed from the soil and should give little difficulty to the children in their being traced back to the soil. Manufactured foods, such as breakfast foods, might give more trouble, but the process of studying the origin is the same as for animal foods.

It is necessary for the children to have some basic understanding of materials of which clothing is made before attempting to determine the source of fibers and leathers. In Louisiana, no difficulty should be experienced with cotton, wool, leather, or synthetic fiber. Nor should such articles as silk or rubber be particularly troublesome to trace to the soil.

Man's shelter may be less plain as coming from the soil than his food and clothing. However, no difficulty should be met with such building materials as lumber, brick, plaster, or stone. It is suggested that, for primary children, little emphasis be given to such materials as steel, aluminum, or other metals.

Suggested Activities:

1. Collect seeds that grow in gardens. Which seeds do we use as foods? Of each seed not used as a food, what parts of the plant that produced it is used as a food?
2. Collect pictures of different kinds of foods. Which foods were produced directly from the soil? Which were produced indirectly from the soil?
3. Examine clothing to see what different materials were used in making it. Which of these materials were produced directly from the soil? Are any of them indirect products of the soil? If so, which ones?
4. Find pictures of houses made of lumber, brick, plaster, stone.

5. Make a brick from clay.
6. What trees in Louisiana are used for lumber?
7. Make an alphabet book of foodstuffs, clothing materials, and/or building materials that come from the soil.
8. Visit a farm or garden to see how food is grown.
9. Make a list of foods you eat that the soil provides. Collect pictures of these foods. Arrange a bulletin or poster.

Possible Outcomes:

1. An elementary understanding that nearly all of man's food is produced by the soil.
2. An elementary understanding that the greater part of the materials used to make clothing is produced by the soil.
3. An elementary understanding that much of the materials used to build our homes is produced from the soil.

2. CONCEPT: SOIL CAME FROM ROCK, AND HAS BEEN FORMED IN LAYERS OF TOPSOIL, SUBSOIL, AND PARENT MATERIAL.

Discussion: Geologists reason that, as the earth's crust cooled it consisted of various kinds of rock that were exposed to the action of atmospheric conditions surrounding the planet. This combined action of moisture, temperature, and wind including the extreme changes in all of them is called weathering. As a result of this weathering much of the softer rock on the earth's surface was cracked, broken, or dissolved over a period of several eons. This broken rock became the parent material of soil. Continued weathering reduced some parent material to particles small enough to be called soil. Meanwhile, powerful forces such as water, wind, gravity, and ice masses moved great quantities of the parent material to new locations and at the same time carried on further weathering of the rocks, continually reducing them to smaller and smaller dimensions. Thus, there are some areas where the bed rock is very hard but the covering soil has been developed from less dense material. For example, soils derived from sandstone, shale, lava, or limestone may sometimes be found covering bed rocks of granite.

The process of weathering should be made fairly clear to primary children. It includes several types of action. Rocks heated by strong sunshine expand, but cooled by night breezes contract. This may start cracks into which water could seep. Temperature changes may freeze the water and, as ice forms it expands with great force, which could cause increases in the size of cracks or extend them deeper into the rock. In such fashion, these forces acting over centuries of time could reduce rocks to smaller pieces. Some of the materials in some rocks will dissolve in water. Thus water could weaken rocks and make them easier to weather by other forces. When some particles became small enough to be picked up by winds, these became active cutting agents on other rocks against which they were blown. Examples of such sculpturing can be seen in some of our western states today.

Much of the parent material of Louisiana's soil has been deposited where it now lies by great masses of moving water as it has made its way to the sea. It was formed elsewhere on the continent and was transported here over the centuries when geologists theorize that this area was sea bottom or river flood plain.

Suggested Activities:

1. Observe a profile of soil such as could be seen in a deep road cut or excavation. Can the layers (topsoil, subsoil, and parent material) be identified?
2. After a brisk wind has been blowing several hours, examine a place where the soil is quite dry and bare. Observe small ridges of soil created by the moving air. Do these indicate how sand dunes might be formed?
3. To simulate the weathering of rock in soil formation, try these exercises:
    (1) Rub together briskly two pieces of limestone or fine sandstone. (If rocks are not available pieces of bricks will substitute.) Catch the fine particles that result on a sheet of paper. Note the time that is required to produce even a small amount of particles. What does this indicate regarding the rate of weathering? What kind of action does this simulate?
    (2) Heat a small piece of rock (preferably limestone) over a flame or on a hot plate. Drop the hot stone into a small pan of ice water. It should crack or break as a result of the rapid contraction on cooling suddenly. How does this illustrate temperature-change effect on rock?
    (3) Fill a small glass jar completely full of water. Cap it tightly and place in a paper sack. Freeze it in a refrigerator or outdoors if possible. Note what happens to the jar. How does this illustrate effect of temperature changes on rocks? (The paper bag is intended for protection against broken glass.)
    (4) Place some small pieces of limestone (or concrete) in vinegar or dilute hydrochloric acid. Action can be hastened by warming. Note the bubbles that form on the pieces of stone. These are carbon dioxide gas that result from chemical change between acid and limestone. How does this simulate action within soil covered by vegetation? (Root hairs of plants give off slight acid juices that contact the soil particles.)

4. Encourage pupils to start collections of small rocks. Each specimen should be identified. Labels can be made as small pieces of adhesive tape stuck on the specimens. An empty egg carton is useful for preserving the collections.

Possible Outcomes:

1. An elementary understanding of the effects of "weathering" on rock.
2. An understanding of some of the principal agents of "weathering".
3. An elementary understanding of the source of most Louisiana soil.

3. CONCEPT: SOILS DIFFER IN COLOR AND SIZE OF PARTICLES.

Discussion: Color is probably the first characteristic of soil that is noticed by an observer. It can be seen in road cuts, ditches, or any place where the subsoil has been bared. Although color is not an important property of soil, it may indicate some more important qualities. Soils may be red, brown, yellow, gray, or black. Darker color usually results from organic matter adhering to the soil particles. Light-colored soils generally have less organic matter in them or more sand. Red- or yellow-colored soils are usually high in oxides of iron or manganese. Also, the color of soil will vary some in relation to its moisture content, water making soil darker than when it is fairly dry.

The size of soil particles imparts to the soil the quality known as texture. Soils may be grouped according to texture as coarse-textured, moderately-coarse, medium, moderately-fine, and fine textured. The coarse particles in soil are sand. Even fine sand can be seen with the eye. But silt particles require the use of a magnifying glass, and clay particles can be seen only with a high-powered microscope.

Loam soils are mixtures of sand, silt, and clay. They are often described according to the dominant type of particle that they exhibit. Thus, a sandy loam is a mixture that is mostly sand, etc.

The texture of a soil determines the ease with which it can be tilled. The coarser textured soils are the more easily worked. Texture also influences the speed with which soil will absorb water and its ability to hold water. Finer textured soils hold water longer. Of course, the amount of organic matter in soil influences all these characteristics as well as the texture. It is also an important quality that helps to determine the productiveness of soil with regard to the growth of food or food crops.

Suggested Activities:

1. Collect samples of soil from gardens or yards. Compare colors. How many different colors can be identified? Compare fineness. Do the samples exemplify sandy soil? Silt? Clay? Loam?
2. Arrange mounds of different soils on a tilted surface covered with a plastic sheet. Use sharp builder's sand as one type of soil. Put a measured quart of soil in each mound. Then sprinkle (fine spray) a quart of water on each mound. Which type of soil is most reduced by runoff? Which type resists runoff best?
3. Describe a circle with a radius of 1 3/4 inches. With the same point as center inscribe another circle with a radius of 3/8 inch. Now make three dots with a pencil near the inner circle. The relative size of particles of sand, silt, and clay are shown by the larger circle (sand), small circle (silt), and dots (clay).
4. Fill a quart jar about two-thirds full of water. Pour in soil until the jar is nearly full. Cap the jar and shake it vigorously. Then set it down and leave it undisturbed until the water clears thoroughly. Note that the soil has settled in layers with the coarse sand at the bottom, next the fine sand, silt, and clay in that order. (If results aren't clear cut, mix some sharp builder's sand with the soil and repeat.) If there is a dark colored layer on top, it is undecayed organic material.

   Repeat the experiment with several soil samples taken from different locations. Compare the profiles when all have settled. What does the comparison show regarding size of soil particles in different types of soil?
5. To show that there are air spaces (pores) between coarse soil particles, fill a half-pint jar about two-thirds full of marbles. Then pour in dry sand slowly, tapping the jar gently so that the sand fills the spaces between the marbles. Stop when the sand reaches the height of the top of the marbles. The jar is no more nearly full now than when you began. Remove the marbles and measure the amount of sand used. Why didn't the sand fill the jar?

Possible Outcomes:

1. A realization that soils exhibit a variety of colors.
2. An understanding that soils vary much in the size of the particles that form them.
3. An understanding that the pores between the larger soil particles may be filled with finer soil particles or even with air.

4. CONCEPT: THROUGH MISUSE OR NEGLECT, SOIL CAN BE LOST.

Discussion: Note has been made of the great amount of time that is required to form topsoil. Authorities believe that it takes at least several hundred years to form a layer of topsoil an inch thick. This fact is significant for two reasons. First, the topsoil is the productive part of the soil. In this layer is found most of the organic matter contained in the soil that makes most of the nutrients it holds available to growing plants. No soil is any better than its layer of topsoil. The second reason is that, if any of the soil is lost, it will be the topsoil that goes first.

Soil losses are sustained through a process called erosion. There are two kinds of erosion--geologic and accelerated. Geologic erosion is the weathering process that operated to form the soil originally. It does no harm. On the contrary it is necessary and beneficial. Without it, the soil would not exist. As has been indicated it is very slow, requiring great periods of time. But accelerated erosion is another story entirely. Through this process great losses of soil are sustained, tremendous damage is done, great economic losses result, and even social changes may be wrought. The agents of all this havoc are the same as those that operated to form the soil, namely wind and water. But it is only through misuse or neglect of the soil by man that either of these forces can do such great damage.

Soil protected by vegetative cover is not subject to erosion by either wind or water to any significant extent. The foliage of growing plants breaks the force of falling rain, causing it to strike the soil gently. The root systems of growing plants hold the soil in place so that even water that can't soak into the soil will not carry away soil particles when it runs off. Neither can wind pick up and move fine particles of dry soil if there is growing on it a protective cover of vegetation. The conclusion then, is logical, that any use to which man puts the soil that leaves it unprotected by vegetative cover will result in soil loss.

At the primary level it is believed the children should be led to understand the importance of protecting soil from loss by erosion and the great principle by which this can be done. But man must use the soil and must learn to do so in such a way that it can be saved while being used. Details of how man often abuses the soil as he uses it for his needs will be reserved for the intermediate level.

Suggested Activities:

1. Visit an eroded area on or near the school ground. What has happened to the topsoil? To the subsoil? Have gullies been started? When did all these things happen? Could they have been avoided?

2. Take a sample of the muddy water from a puddle after a heavy rain. Let it set until the water clears. Examine the sediment. Of what is it composed? Where would it have been deposited normally? Is this good, or bad? Why?
3. Observe the base of a tether-ball post after a hard rain. It is assumed all the grass will be worn off from around it. Note the soil particles adhering to the lower part of the post. How did they get there? How high do they reach on the post? What does this show about what happens when heavy rain drops strike unprotected soil?
4. While trees are in full leaf (spring or early fall) note how dry the ground under a dense shade tree remains after a brisk but brief shower. What did the foliage of the tree do to the falling rain drops? Does this give any indication of the way soil is protected by vegetative cover?

Possible Outcomes:

1. An elementary understanding of how soil can be lost through the action of water or wind.
2. An elementary concept of the value of keeping soil protected by a vegetative cover.

5. CONCEPT: WATER IS NECESSARY FOR ALL LIVING THINGS.

Discussion: Both plants and animals require water to maintain life. Water is so closely associated with soil that we always need to study them together. Plants can use the soil nutrients only in forms that are soluble in water, because plants take in water with their roots. In this water must be carried all the things plants need from the soil. Much water is needed for such purposes. A corn plant requires fifty gallons of water to mature one ear of corn. Five thousand gallons are required to produce a bushel of corn. It takes four thousand gallons to produce a bushel of wheat. Eighty gallons will produce a pound of cotton, ninety-three gallons a pound of soybeans, and one hundred gallons a pound of hay. For every pound of beef we eat, 1300 gallons of water were required to produce its food, what it drank, and the processing of the meat in the packing house.

Livestock need water for body use. A milk cow requires fifteen gallons of water each day. Other cattle and draft animals need ten gallons per day. A hog needs four gallons per day, a sheep about three gallons, even a chicken must have nearly half a pint daily.

Man uses water not only for drinking, but for so many other purposes each day that his use of water is a fairly good index to his standard of living. It has been shown that, whereas the population of the United States doubled from 1900 to 1950, the daily consumption of water in the same period increased fourfold. It is estimated that by 1975 water use will be increased an additional 40 per cent.

These facts should be digested in light of the understanding that the supply of water remains the same. There is just so much water on this earth.

Suggested Activities:

1. List all the ways the children can think of that water is used at school. Then have each child list the ways water is used in his own house.
2. Make a list of the ways the human body needs and uses water.
3. List all the ways the class members can think of that water is used by other animals.
4. Place a seed (bean or corn grain) between two pieces of blotting paper and put in a small dish. Do the same for a second, similar seed. Keep the blotting paper quite moist in one dish (don't let it be covered by water) and keep the other dry. After three or four days observe the seeds to discover differences, if any. Draw conclusions.
5. Observe two similar potted plants, one that is watered regularly, the other not at all. What differences develop? Draw conclusions.
6. Make a list of animals that live in water. How do some of them differ from land animals? List plants that live completely immersed in water.
7. Observe farm animals around a farm pond. Try drawing pictures of such a scene.
8. From reading, try to find out the length of time some animals can live without water. Eg. man, camel, lizard, fish.

Possible Outcomes:

1. An elementary understanding that water is necessary for living things to continue living.
2. A realization that some plants and some animals actually live in water, and would die if removed from it.

6. CONCEPT: WATER CAN BE WASTED.

Discussion: The actual amount of water in the world is fairly constant. Rarely is any water really destroyed. Nor is the formation of water resulting from the oxidation of hydrogen compounds of any considerable importance to the supply. By far the largest amount of water is that making up the oceans, and it cannot be used for any of man's body needs or for those of most land animals or plants. To all intents and purposes the usable supply of water is limited to the amount of fresh water available.

Primary children are probably too immature to be exposed to the concept of the hydrologic cycle, so the fundamentals of the available water supply will have to be postponed until they are older. But they are capable of understanding the general principle of waste. This principle is applicable to the many ways water is used. Ultimately fresh water is wasted any time it is allowed to flow down a stream and enter the sea without having been used to perform any function for which we would normally use it while on its way.

There are some more specific ways children can learn to avoid wasting water. Residents of any size city that has a water system have to pay for their water service--usually in proportion to the amount they use. Any time a faucet is opened in such a system water flows for some household or commercial use. If the water is permitted to run down the drain without being used, at least the cost of it has been wasted, though it may run into a sewer plant where it is treated and later perform some useful function farther down stream.

Pollution of water from any practice could probably be justified as being termed wasteful, but it will not be discussed here. Concept No. 8 will deal with this problem at length.

Suggested Activities:

1. Find a leaking faucet at home or at school. Catch the drip from it for a measured period of time. Measure the amount of water caught and compute the amount that would be lost in a complete day and night. Draw a picture of a dripping faucet.
2. Observe and describe the runoff of water on the school grounds during and immediately following a heavy rain. Discuss the amount of water that has run away. Discuss what fraction of the amount that fell ran off.
3. In the classroom sandbox construct a model of a farm pond. Discuss how such a pond might save a large amount of the rainfall on its watershed. What might such water be used for?

4. List all the ways you can find in which water is wasted around your home. Can you suggest some means by which some of this waste could be avoided?

Possible Outcomes:

1. A realization of the seriousness of the waste to the supply of water.
2. An elementary understanding of ways in which water may be wasted.

7. CONCEPT: FLOODS DO GREAT DAMAGE.

Discussion: Practically everyone has seen some example of a flood either small or large. Flooding results when rain falls in an amount much greater than the soil can absorb. The portion of the rainfall that does not soak into the soil answers the pull of gravity and runs downhill as far as it can go. It may overflow fields, roads, towns, or whatever lies in its path. It will fill low areas until it spills over their limits and run on to lower places. The damage done by flood waters is tremendous. It includes not only the harm done by excessive wetting, but also the actual physical force of the running water may knock down buildings, tear out railroads or highways, capsize bridges, uproot trees, or sweep almost any fixed object before it.

One of the greatest forms of damage resulting from floods is the transportation and deposition of soil and other debris. When water runs down a wet slope it carries with it soil particles. The more soil it gathers the greater its ability becomes to cut the soil. This is soil erosion, and results in irreparable loss to the soil because one flooding may take away as much topsoil as was formed in the previous fifty to one hundred years. This is very bad, but may not be all the trouble. If, on its plunging to lower levels, the water is slowed sufficiently in some low or level space, much of the soil it is carrying is deposited. This sediment may cover wide areas with unwanted deposits that have to be removed after the water has receded. Soil deposited in this way may fill expensive reservoirs that have been built to provide water supplies to large cities. If the sediment is deposited around the mouths of great rivers, constant dredging becomes necessary to keep channels open for the passage of large ships. When the pressure of flood water enlarges great rivers, levees may be broken permitting the mud-carrying water to spread over thousands of acres of rich farming lands where the silt is deposited as the water slows. This may well cause an expensive decrease in the productiveness of these fields.

It is difficult to imagine any good resulting from a flood. The harm may be tremendous and may be felt hundreds of miles from where the flood started.

Suggested Activities:

1. Have a discussion period on the morning following a very heavy rain. Perhaps some of the pupils who come to school on a school bus saw a place where the road was covered with water overflowed from a creek or bayou. Perhaps some of them experienced having the school bus necessarily making a roundabout route because some road was impassable because of overflow water. Or, perhaps some of them have seen a bridge or road fill washed out by high water. Any such experience could be described for the class. Sometimes school busses must make detours for several days for such reasons. List the types of damage and inconvenience that result from such occurrences. Accompany such a list with a definition of flood.
2. In the library files of the daily newspaper find pictures of conditions resulting from flood in wide areas. Recent examples might be the disasters that affected Fairbanks, Alaska, all of South Texas after the hurricane last summer, or New Orleans and south Louisiana following the hurricane a year earlier. Draw conclusions about flood damage, and the kinds of conditions that cause floods.
3. Try to find an area where overflow water has receded. Observe the film of deposit that has been left. Of what is it composed? Where did it probably come from? What effect will it probably have where you see it? Could it possibly have a different effect if it had been deposited somewhere else? What happens to lakes or reservoirs under such circumstances? What would be the effect on a fertile farm field? Suppose the deposit were thicker. Would the effect be the same? Draw conclusions.

Possible Outcomes:

1. An elementary understanding of the conditions accompanying a flood.
2. Some realization of the kinds of damages that result from a flood.

8. CONCEPT: THERE ARE MANY WAYS WATER CAN BE MADE UNCLEAN.

Discussion: Water may be sparkling clear but still be unfit for us to use. Such water may be contaminated with disease germs that we cannot see or taste, but drinking it could cause an epidemic in a community. Not all unclean water looks unclean. We would not want to drink water from a stagnant roadside pool, and probably we would be right in such hesitation. Such water would probably be loaded with small plants and animals that might cause sickness, but we could not be sure just by its appearance.

Water can be made unfit for human use by being allowed to catch drainage from sewer systems of any urban district. Many cities pour their untreated sewage into creeks and rivers with little thought for those who live further downstream and who might take water from the stream for their regular water supplies. No inhabited area should dispose of sewage in such a manner unless it is first purified in a treatment system that guarantees that the runoff will not contain any live organic matter.

Some industries also help to make water unclean by permitting their waste materials to run off into some nearby streams. Such waste water may contain acids or alkalies or harmful salts which would kill aquatic plants and fish in the stream, making the water further unclean. Waste materials from oil field production also render flowing streams uninhabitable by fish and other aquatic animals.

Even natural causes can render water bodies unclean. When runoff rainwater carries great loads of mud into streams and lakes, the fish and other living things in the water are usually driven away until the water clears up by the settling of the silt to the bottom.

It is felt that primary children should develop a sense of respect for clean water and should learn the principle of protection of water bodies and streams from any unnecessary pollution. They should build a hesitation to throw anything in lakes or streams that might result in making the water unclean--unfit to use for swimming, for drinking, or for any household use.

Suggested Activities:

1. Discuss ways water may be made unclean. Can it be unclean while still looking like good, clean water? Investigate the possibility of some pupil's having known of water from a spring or shallow well that health authorities had condemned. Make a list of ways water can be unclean.
2. Make a chart showing ways we can help keep water clean.
3. Examine pictures of polluted water caused by wastes from some industry. Would such water be safe to drink? To swim in? Could fish live in it?

4. Fill a glass bottle or small fruit jar two-thirds full of water. Add a couple of spoonsful of oil. Shake the mixture vigorously. Do the oil and water mix? Where does the oil accumulate? Why? What would happen to fish in water covered by a film of oil? Why? Dip a clean, white pipe cleaner in the mixture of water and oil. Examine the pipe cleaner when it is removed. This is the same thing that happens to waterfowl that alight on oily water. What happens to such unfortunate birds? What might be the source of oil that pollutes a stream or lake?

Possible Outcomes:

1. A realization that water may be sparkling clear but still be unfit for human use.
2. An understanding that there are many ways water may be unclean.

9. CONCEPT: WATER IS A SOURCE OF RECREATION.

Discussion: Most primary children have played in water. If they haven't yet learned to swim they have probably enjoyed wading in shallow water. With these experiences for background, they will enter enthusiastically into a discussion of ways water can be used for recreational purposes.

Included in such a discussion should be the enjoyment by people of such activities as swimming, diving, boating, skiing, and fishing. Some emphasis should be placed on simple rules of water safety. It is awful to realize how many deaths occur from drowning each year in Louisiana alone. Probably very few of these lives would be lost if simple rules of water safety were learned and observed.

This kind of discussion is also a fine place to emphasize that none of these forms of recreation and fun can be safely carried on in bodies of water that are polluted to any noticeable degree.

Suggested Activities:

1. Have the pupils find pictures of ways people have fun in or on the surface of water. Make a chart by mounting some of the best pictures brought to class.
2. Have each child name some of his favorite places to swim, to fish, to have picnics, or to go boating. Make a list

of the combined total of locations where the pupils have enjoyed such experiences.

3. Divide the class into committees. Have each group list safety rules for activities they have enjoyed in carrying out water activities.
4. Discuss the children's favorite picnic areas, leading each to tell reasons for the favoritism. Also, discuss how families picnicking should leave the picnic areas when departing. Have children construct "litterbugs" out of such materials as should be gathered up after a picnic. Display some of the best creations.
5. Have children attempt to give reasons why people should engage in recreational activities. Make a list of all good reasons suggested.
6. Have children construct mobiles of persons enjoying some water-oriented form of recreation such as fishing, skiing, swimming, or etc. Use soft wire, pipe cleaners, or some such materials. Tie some of the best efforts together and suspend them where the breeze will move them about.

Possible Outcomes:

1. An elementary understanding of man's need for recreation.
2. A partial realization of recreational possibilities that are water-oriented.

10. CONCEPT: BOTH SOIL AND WATER SHOULD BE USED WISELY.

Discussion: In the first nine concepts, the children have learned something of the importance of soil, how it was formed, how soils differ in color and texture, and that it can be lost if misused or neglected. They have also learned that water is a necessity for life, that it can be wasted, what happens when we get too much water, that it can become unfit to use, and how people can use it for play and recreation. This final concept deals with the conservation of soil and water. By definition "conservation" means "wise use". Perhaps the chief problem for most teachers will be finding basic understandings about soil and water conservation that are elementary enough for primary children to grasp.

It is believed that these pupils can see how runoff water during and after a rain has picked up and moved soil to the extent that there is actual loss of soil by erosion. They should also be able to understand how grass roots help to hold the soil and protect it from loss by wind or water. Of course, this applies to forests and other vegetation as well as grass. They can observe places where soil loss was great as it is exemplified in gullies caused by runoff water. They should be able to understand that it is usually the top soil that is lost--the important part for growing plants and that what is lost in one night may have required a century to build.

Primary children should also be able to realize the importance of water and how it can be wasted. The damage caused by floods should be within their abilities to grasp and the idea that if water were slowed down where it fell, there might be no flood.

Nor should it be too difficult for them to understand why some bodies of water are forbidden to them for swimming or wading because the water is in some way polluted. Water as a source of recreation is within the understanding of any child. He will grasp the need for conserving it to the extent of his experiences with it.

Suggested Activities:

1. Make a class excursion after a heavy rain. Find an area where fresh erosion of soil has occurred. Make some careful observations. Why did the runoff water move soil? Was the soil protected by growing plants? What part of the soil was moved? Were gullies started or deepened? Was any of the eroded soil deposited where you can see it? Why did this happen? What is now the condition of the area from which the soil was moved? Is this area improved or damaged? Could the soil loss have been prevented? What must have been the condition of the water by the time it ran off the eroded area? Was this good? Write a short story telling all the things observed on this trip and tie them together as causes and effects.
2. Establish a conservation center in the classroom. Use a fairly large table and support a piece of beaverboard or some such material like a bulletin board at the back of the table. Collect and display different kinds of soil placed in jars and labeled. Find different kinds of rock from which soil is made. Display and label. (A good way to keep rocks is to imbed them in plaster of Paris poured into a cardboard box. When the plaster hardens, remove the box.) Display in labelled jars different kinds of fertilizer and crushed limestone. Also, seeds of grasses that help to prevent soil erosion, and of plants like legumes that enrich the soil while growing. Whole plants, such as grasses with roots that hold soil against erosion, and clovers with nitrogen nodules on roots, would add to the value of the display. Make labels brief but informative.

On the erect background could be displayed pictures of terraces, strip cropping, and other soil conservation practices designed to reduce soil loss from erosion. Displays could and should be changed occasionally as different emphases on conservation are undertaken. Let the children make and be responsible for the displays.

Possible Outcomes:

1. An elementary understanding of the need for reducing soil loss from erosion.
2. Some understanding that practices used to reduce soil erosion are also valuable for water conservation.

INTERMEDIATE

1. CONCEPT: PLANTS AND ANIMALS DEPEND ON SOIL.

Discussion: Children at the intermediate level should experience no difficulty with this concept. Already they know that plants grow in the soil, and that the green plants make their food from water and nutrients obtained from the soil combined with the oxygen from the air. In fact, they should know by this time that green plants make all the food there is--not only what they use themselves, but also that used by animals and by plants that are not green. Of course, since man is, biologically, an animal he, too, is dependent on the food manufactured by green plants.

The point of emphasis here is the matter of how the green plants are related to the soil in the performance of this function upon which all living things are dependent. It should be made clear now that the soil provides an anchorage for the plants, where they can obtain a supply of water that has dissolved in it needed minerals (ordinarily referred to as soil water) and where they can hold up their leaves to catch sunlight so necessary for them to carry on the process of food manufacture. The holding of the plant (anchorage) is important for it should be noted that even where plants are grown hydroponically, they have to be held in erect position by some artificial means.

Animals depend on soil for food indirectly, inasmuch as they eat plants or the food they have stored for their next generation. Furthermore, most animals seek some kind of shelter at times in their lives. Such shelter as animals in their natural conditions use will be either above or below the surface of the soil. If above, it will be provided by plants that have grown in the soil or will be constructed from plant materials. Animals also need water, which they usually obtain from a source either on or below the surface of the soil.

Suggested Activities:

1. Model animals (farm and forest) from clay. Tell how they get food from the soil. Tell how they get shelter from the soil. Draw pictures of animals eating (with crayola). In each case, note the source of the food the animal is eating.
2. To show that soil provides anchorage for plants, select a good-sized weed and pull it up gently. Note how firmly it is held in the ground. Notice the root spread, how deep the roots grow, and how firmly packed the soil is. In what position was the plant held by the roots?

3. Trace back to the soil, step by step, the origin of things we use. (This can be a group activity, using the chalkboard. Or, it can be a competitive exercise between individuals, or committees.) Select items of food, clothing, shelter, or in any other category that can be so traced appropriately. Example: Shoes - merchant - factory - tannery - packing house - stock yard - farm - cattle - grass, corn, other feedstuffs - soil.
   Example: Wooden chair - furniture store - factory - sawmill - lumbering industry - tree - soil. For complex items, different ingredients may be entertainly and revealingly traced individually. This activity can be carried on to any extent.

Possible Outcomes:

1. An elementary understanding that plants depend upon the soil for anchorage and for the water and mineral nutrients they use to make food for their growth.
2. A basic understanding that animals depend on the soil to produce plants they eat, while many of them find shelter in the soil or among plants grown in the soil.

2. CONCEPT: SOIL IS A MIXTURE OF WEATHERED ROCK AND ORGANIC MATERIAL.

Discussion: The term "organic" refers to objects that are or once were living. At the intermediate level the function of living things in soil formation should be emphasized. This includes both plants and animals during and after their spans of life.

It is believed that lichens were the first forms of living creatures to influence soil formation. These tiny plants clung to rock surfaces and grew there. Rudimentary as was their existence, they still affected the rock's surface with their life processes, softening it somewhat while alive and contributing their decomposed tissues after death. After centuries of such contributions they made possible the development of some higher organisms such as mosses. Step by step, as soil formed, more complex forms of living things developed. Each in turn added its influence by dissolving mineral materials and adding its decomposed remains to the soil that was being formed by elemental forces. Also step by step, a better soil was being made that would support a further-developed type of living creature. When plants with roots came along the process of weathering was accelerated by the acids they exude to dissolve minerals and enlarging of cracks in rocks by the pressure exerted by growing roots. (Most children have seen cases of sidewalks having been lifted and broken by tree roots.)

Nor should this whole process be confined to thinking in terms of plants only. Tiny, one-celled animals appeared and added their decomposed remains to the organic contents of the soil when there life spans were completed. As they developed in complexity their influences were felt in soil making by their movements in the soil letting air and water permeate below the surface to hasten further opportunities for weathering by both these agents.

Most of the organic matter found in soil, as we know it today, is located in the topsoil layer. In general, the fertility of the soil is directly proportional to the amount of organic matter it contains. Usually referred to as "humus", the organic matter in soil tends to give the topsoil a darker color than the subsoil and is the principal determiner of the soil's productiveness and tilth.

Suggested Activities:

1. Search in deep road cuts, ravines, or on steep hillsides for rocks that have lichens or moss (or both) growing on them. Carefully remove some of the growth. Note that there are small particles of rock that adhere to the lichen or moss. These were loosened from the rock by the action of the growing organisms. Could such plants have helped in forming soil when the earth was young? (Incidentally, learn of what a lichen is composed.) Could lichens be included in a list of weathering agents?
2. Weigh a good-sized piece of dry sandstone. (To be sure it is dry warm it gently in an oven for a couple of hours.) Record the weight. Now soak it in water overnight. Weigh it again. What weight of water has it absorbed? Wrap the wet stone in foil and place in the freezing compartment of a refrigerator. Leave overnight. Remove and examine the rock. Are any changes visible? Explain. Does this help to illustrate weathering of rock to form soil?
3. Filter about a pint of distilled water through the soil contained in a full, inverted lamp chimney covered at the bottom with cloth. When it has stopped dripping evaporate the water slowly. Is there a residue? Where did it come from? To prove its source, evaporate an equal amount of distilled water. Does this prove it? How could water seeping through rocks change them? Would this help form soil?
4. Go into a forest. Take a sample of soil from the surface of the forest floor. Now dig down twelve inches and take a sample of the soil at that level. Examine both soils

with a hand lens to observe the size of the particles. Compare the two samples of soil as to color, texture, and amount of organic matter.

5. Take two samples of a soil. To one add an equal amount of sphagnum peat moss, and mix well. Make two percolation cylinders of soft drink cans by punching holes in the bottom of each. Fill one can with the soil as the sample was taken. Fill the other with the soil mixed with the organic material. Suspend the cans. Add water to each and count the number of spoonfuls added until water drips from the bottom of the can. How does organic matter change the water-holding capacity of soil?

Possible Outcomes:

1. Further understanding of the formation of soil from weathered rock.
2. More adequate understanding of the action of different agents of weathering.
3. Some concept of the way sedimentary rocks are formed.
4. An elementary understanding of the organic material to be found in soil.

3. CONCEPT: TYPES OF SOIL ARE DETERMINED BY THE PARENT MATERIAL, CLIMATE, LOCAL TOPOGRAPHY, VEGETATION, AND TIME.

Discussion: The term "type" as applied to soil refers to its characteristics and its suitability for certain uses. The type of soil that forms in a particular area is determined by the factors listed in the statement of the concept.

Soils have all been formed from parent material, which was either residual--in the same location where it always was, or transported--moved to another location by water, wind, gravity, or ice. All these kinds of parent material can be found under southern soil except that transported by glaciers. Naturally, soils formed from parent materials of different kinds and properties will differ in texture and fertility.

Climate refers to rainfall and temperature. Both have much influence on soil. Soils formed in areas of comparatively high rainfall are likely to be leached by the water with the result that the soils are probably acid. Higher temperatures cause soil to weather more rapidly. The soil in areas of both warmer temperatures and higher rainfall are, therefore, more likely to need lime and fertilizer for sustained crop yields. Also, the supply of organic matter is more difficult to maintain under such climatic conditions.

Topography means the lay of the land with regard to levelness or slope. Soils differ if they were formed in level areas, or gentle slopes, or on steeper slopes. Soils formed in level places have a tendency to be poorly drained and are likely to be underlaid with an impervious layer sometimes called "hardpan". Soils formed on steep slopes are likely to have been eroded nearly as fast as formed and are, therefore, shallow and leached of most of their valuable ingredients. The best upland soils are those that were formed on gently rolling slopes. Such soils are usually well drained and most productive because they have maintained most of both their mineral and organic materials.

The type of vegetation native to an area has influenced the soil as it was formed. Soils formed under a covering of grass or hardwood trees is of better quality than that which formed under a covering of coniferous vegetation. Early settlers probably chose their farm sites in accordance with the types of vegetation they found. It was probably a meaningful guide for them to follow.

The factor of time has been very important in the formation of soil. It is believed that hundreds of years are required to form an inch of topsoil. Most soils are thousands of years old. This becomes more important to everyone when it is considered that, if left unprotected or not wisely used, as much as an inch of topsoil may be lost from a field as a result of a single heavy rain. Protection of the soil is one of man's most important responsibilities.

In summary, soils differ in their suitability for the various uses man may seek to make of them. For purposes of food production, the soil should be fertile, well drained, porous, and lie so that it can be cultivated easily with modern machinery. In Louisiana, the best agricultural soils are the alluvial bottom lands that are fairly level. Another characteristic that makes them better producers of crops is the fact that such soils are younger than the soils of hilly regions and are, therefore, less likely to be leached of much of their desirable substances. Some soils are unsuitable for homesites or location of other buildings because of their tendency to shift, or swell, or contract, in response to wetness at different seasons.

Suggested Activities:

1. Examine samples of limestone, sandstone, and shale. These are among the most common types of rocks included in parent materials of soils. Learn from books the meanings of "residual" and "transported" as the terms apply to parent materials of soil. Also, learn how transportation might have been accomplished by wind, water, or ice.

2. Study a rainfall map of the United States. Since rainfall is one of the chief factors of climate, consider it with what is known roughly of the temperature zones in the U.S. Both warmer temperatures and heavier rainfall help to promote leaching of soil. In what regions of our country would you conclude soil has probably sustained greatest damage from leaching? Would this affect color? Organic content? Fertility?
3. To investigate the influence of topography on soil formation take samples of the soil on top of a large hill, at the bottom of the hill, and from a nearby level area. Examine the samples of soil for color, texture, (Use hand lens to see particles) and apparent organic content.
4. Examine the soil profiles in road cuts that were made through well-sodded pasture lands and through a forest area. Can any differences be detected? Could such differences have been caused by vegetation? Study soil samples from the floor of a pine forest and the floor of a hardwood forest. Can any differences be noticed? Could these be traced to the kinds of vegetation growing on the soil?
5. Consider the time believed to have been required to form soil that probably remains where it was formed. Consider also the time that was probably required to build some alluvial soil where it is now. How do the two compare? How does either compare to the ordinary span of life of man? How long might it take to lose a high per cent of either type of soil considered? Draw conclusions.
6. Study the fascinating story of the great Mississippi River. Trace its course and consider the area it drains. Locate the "delta" areas in Louisiana--both lateral and terminal. Learn the meaning of "alluvial".
7. Construct an artificial soil profile. Use a tall, slender, clear glass bottle such as an olive bottle. Visit a place like a road cut that is fairly deep where topsoil, subsoil, and parent material can be observed. In the bottom of the bottle place some parent material, next add some subsoil and, finally some topsoil. Use estimated depths in the bottle that correspond to what can be seen where the samples are taken. Cap the bottle for a permanent exhibit in the classroom.
8. Find some subsoil that is heavy, sticky clay. Mix some with water until it is about the consistency of thick batter. Pour it into an old baking pan or flat wooden box to a depth of about an inch. Set to dry. After it is dried, examine to see its characteristics. Has the edge pulled away from the container anywhere? Are there any cracks? Any bulges? After examining, again moisten it slowly. Do the deformities

reduce or disappear? Would this kind of soil be suitable as a site for a home or other kind of building? What might happen to a house built on such soil?

Possible Outcomes:

1. A realization that soils differ in such characteristics as color, texture, organic content, and water holding ability.
2. A realization that a variety of factors influence the types of soils that have been formed.
3. An understanding of what these factors are and, to some extent, how they helped to determine soil types.
4. A realization that some soils are not suitable for some uses.

4. CONCEPT: MAN'S MISUSE OF THE SOIL HAS MADE POSSIBLE EROSION BY WIND AND WATER.

Discussion: Before the advent of the white man in America, the soil existed in its virgin condition. White men were not content to make their livings by hunting and fishing alone, but sought to produce much of their food by tilling the soil. Since early in the seventeenth century, soil in America has been used and often abused. Whenever soil is used for growing crops and left exposed to wind and rainfall some loss by erosion has occurred. There are many ways man can misuse and has misused the soil that resulted in erosion.

The early settlers cleared forests from the land to make fields for cultivation. This practice need not have been misuse of the soil, unless the crops produced were clean harvested and no cover was left on the soil. If this was done, particularly on slopes, loss of topsoil quickly followed.

When rain falls on unprotected soil, only a small fraction of it is absorbed. The remainder runs off, and if the land is a slope, it runs off rapidly. Fast running water can carry more soil than that moving slowly, so the steeper the slope the more soil loss that results. Streamlets of water carrying soil (muddy water) cut into the soil faster than clear water would do. Thus, erosion compounds itself. Cultivation of soil, then, is likely to result in loss of soil unless the soil is protected during the process. Good use of the soil is necessary for man's existence. Protection of the soil is also necessary for his continued existence.

It took the people of America a long time to realize that the soil must be protected for future use or there would not be a future. It has been estimated that an average of about half America's topsoil has already been carried away by wind and streams, most of it having been deposited in the ocean or in lakes and reservoirs where it is harmful in the filling.

Other ways man has exposed the surface of the soil to the effects of erosion include overgrazing forests, thus stripping the forest floor of its litter cover, and by overgrazing the prairie, thus removing or thinning the protective cover made by grass. Burning or permitting the burning of either type of area has the same result. The protective cover of the soil is destroyed. Cultivation of row crops on sloping fields where the rows are planted up and down hill is another way man can misuse soil and make possible loss by erosion. Even small grain crops drilled up and down slopes will permit runoff water to damage soil. Cultivation on prairie land by plowing sod and planting crops makes possible soil erosion by wind when very dry weather occurs. This practice has started some great dust storms. Man has also abused the soil by leaving cultivated fields bare through winter months. Such fields should carry a cover crop in that season when the heaviest rains may be expected.

Under concept no. 10 that deals with conservation of soil, students will see how the soil may be used regularly while at the same time protecting it in ways that have been found successful to permit its constant utilization with little or no loss.

Suggested Activities:

1. Arrange two sloping, plastic-covered surfaces about two feet by three feet so runoff from the surface can be caught. On one surface put soil to a depth of about two to three inches. Cover the other similar surface with blocks of sod about three inches thick taken from a fence row. Sprinkle each area with equal amounts (approximately two gallons) of water. Catch the run off from each separately. Measure each quantity of runoff water. Why did the sod permit less runoff than the bare soil? Examine the runoff water. Which quantity has more sediment? Why? Draw conclusions.
2. Repeat the experiment in no. 1, except instead of pouring water on each sample, train an electric fan on it. Watch for dust escaping from the unsodded sample. Draw conclusions.
3. Using the same apparatus that was used in activity No. 1, cover two sloping surfaces with pulverized dry soil to a depth of 2 to 3 inches. Using a finger or some blunt instrument, make tiny furrows on both surfaces to simulate rows of crops. On one surface run the rows up and down the slope, on the other make them perpendicular to the slope. Now sprinkle each with the same amount of water. Which surface permits more runoff water? From which surface is more soil removed

by the water? Learn what "contour cultivation" means. What advantages are gained from using this practice?

4. Again, using the same kind of apparatus and two surfaces of fine dry soil (as in No. 3) build simulated terraces across the slope on one surface. Sprinkle both slopes with water and observe results. Draw conclusions.
5. Once more, using the same kind of preparations as in No. 4, embed on one sloping surface strips of sod perpendicular to the slope about a foot apart. Sprinkle both surfaces with water. Observe results. The strips of sod simulate the practice of "strip cropping". Learn how farmers practice this device on sloping fields. Draw conclusions.
6. Learn the meaning of the terms "sheet" erosion, "gully" erosion, "geologic" erosion. Take a field trip and try to locate and examine examples of each type.
7. Make a list of ways man might misuse soil so as to leave it bare when crops are harvested or forest cover cut or burned.

Possible Outcomes:

1. Further understanding of how soil can be lost through action of water or wind.
2. A more mature concept of the value of protecting soil with a vegetative cover.
3. A realization of ways man can abuse soil that result in heavy loss of topsoil.

5. CONCEPT: MAN'S NEEDS FOR WATER ARE MANY AND VARIED--AGRICULTURAL, INDUSTRIAL, TRANSPORTATION, MUNICIPAL, RECREATION, ETC.

Discussion: It has been shown that man's use of water in America has increased in greater proportion than the population has increased. It is estimated that by 1975 America will be using for all purposes about 1800 gallons of water daily for every individual in the nation. This includes all the various ways man needs and uses water. In 1950, according to the U.S. Department of Agriculture, the daily per capita use of water was 145 gallons. This included residential use of 50 gallons, industrial 50 gallons, public (municipal) 10 gallons, commercial 20 gallons, and other uses including losses of about 15 gallons. This does not include the tremendous uses by agriculture including irrigation. All uses are estimated to be increasing rapidly to the point that, by 1975, they will have increased forty per cent over 1950.

There are no records of rural uses of water because they are met from private sources. Rural homes with running water are estimated to use about 50 gallons per person per day while homes without running water are believed to use about ten gallons per person per day. These are domestic uses only, and do not include livestock needs. For the whole nation, it is estimated that, in 1955, rural homes used two and one half billion gallons daily. In 1955, it is estimated that ninety-one billion gallons per day were used for irrigation. About seventy per cent of this came from surface water sources--lakes, ponds, and reservoirs--while thirty per cent was taken from wells. Use of water for irrigation is not uniform throughout the year, being much greater during the season when crops are growing.

In American industry, water is the chief raw material used. In 1950, industry is said to have used 120 billion tons of water. More than ninety per cent of industrially used water comes from surface sources, including rivers, while the remainder is taken from wells. In 1955, an average of 1500 billion gallons of water was used daily to generate electricity. Practically all of this water is returned to streams. Often this same water is later used for irrigation purposes.

Water is indispensable to the lives of fish and waterfowl, from which a large proportion of the recreation of our citizens comes. Except in cases of draining and refilling swimming pools, recreational uses do not consume water. Water is necessary for boating, skiing, fishing, swimming, and some types of hunting but is not consumed (except as noted above) when serving any of these needs.

Tremendous amounts of bulk freight are transported on inland waterways in America. Here, again, water is used extensively but without being consumed.

Suggested Activities:

1. Visit a farm in your community where there is a farm pond. Learn what various uses are made of the water the pond holds. Inquire as to the cost of building the pond, and whether or not it has proved to be a good investment for the farmer.
2. Visit a farm where irrigation is used to supply growing crops with water. Determine the source of the water used for this purpose. Learn whether gravity or pumps have to be used. Also, learn the time of year when this practice is followed, the cost of the practice, and the profit usually yielded by the practice.
3. Determine the source of the water supply in your own community. Is it surface or underground? How many miles of main pipes are used, and what are their sizes? Inquire if shortages ever occur, and what practices are followed if and when they do. Learn how the purity of the water is rated by the State Board of Health.

4. Invite a member of the local Chamber of Commerce to speak to the class about the importance of water supply in attracting industry to your locality. Learn from him what industries in your community are dependent on water for their operation, and approximately how much water they use.
5. Inquire of the State Department of Commerce and Industry about the magnitude of water transportation on the inland waterways of Louisiana, including the intracoastal canal. Locate this canal on a map of the state. On an outline map of Louisiana mark the principal navigable inland waterways of the state. Estimate their combined length in miles.
6. Make a list of the areas in your own parish where water recreation is enjoyed. Make a similar list for the state as a whole. Mark any that have been enjoyed by members of the class. Have the children prepare a mural showing different types of recreation that depend on bodies of water.
7. Write a theme describing an imaginary ride on a barge train and tugboat on some of Louisiana's navigable waterways. Tell what sorts of traffic you might meet, and describe the kind of scenery you might observe as you proceed.

Possible Outcomes:

1. An elementary understanding of the variety of uses made of water for agricultural, industrial, municipal, recreation, and transportation purposes.
2. A realization of the effect of a lack of water on any of these various forms of activities.

6. CONCEPT: WATER IS FOUND ABOVE THE GROUND, ON THE GROUND, AND UNDER THE GROUND.

Discussion: The air always contains water vapor. Warm air can hold a large amount of water vapor, but when it is cooled some of the vapor condenses and becomes too heavy to remain suspended in the air. When it condenses into liquid form, rain falls. If the vapor is cooled more rapidly it condenses directly into the solid state and snow falls. Either is called precipitation.

Precipitation is responsible for the supply of water on any land area. When rain falls, some of it evaporates as it falls, more on warm days than on cooler days. On an average day it is estimated that, of the rain that reaches the surface of the earth, about one-third evaporates into the air, one-third soaks into the soil, and the other one-third runs off on the surface of the ground in response to the pull of gravity. The part that evaporates will fall again somewhere as soon as the air carrying it becomes sufficiently cooled. Some of the part that is absorbed by the soil remains in the soil to be used by plants, while some of it percolates deeper and becomes part of those underground streams and pools that are often referred to as the water table.

The part of the water that ran off on the surface of the ground is collected into streams and lakes. By the construction of dams across streams, man has become able to hold large quantities of surface water for use when rain isn't falling. Such bodies of water are called reservoirs. Many cities obtain their regular water supplies from such impoundments of surface water. Farmers sometimes use smaller reservoirs for supplying the needs of livestock and for irrigating crops in dry periods.

Holes drilled or dug into the earth to tap underground water supplies are called wells. Much of the water used by man for various purposes is produced from wells. Sometimes wells "go dry" in seasons of drought. The reason is that there has been too little rain in the area where the underground storage begins. It may be many miles from the dry well, for underground streams are known to travel long distances in some earth formations.

It is suggested that the teacher guide the students into studying the principle of underground water storage in a good physical geography or earth science textbook.

Suggested Activities:

1. Empty a tray of ice cubes into a glass or metal pitcher. Add enough water to cover the ice. Let the pitcher stand a few minutes in the classroom. Watch for the formation of a film of moisture on the outside of the pitcher. Where did this water come from? Could it be seen before it condensed on the pitcher? Is there any difference between this moisture and the dew that forms on the grass during a quiet (not windy) night? (Remember dew forms where it is seen. It does not fall.) What is frost? Learn the meaning of the term "relative humidity". If the relative humidity is the same on a day when the temperature is 40°F and one on which it is 80°F, on which day is there more actual water vapor in the air?
2. In books on physical geography or earth science find diagrams of the water table. Learn all you can about the water table. Try to learn how deep under the ground the water table is where you live, or where your school is located.

3. Visit a home where the family water supply comes from an open (dug) well. Learn how deep the well is, and how deep the water stands in it in normal times. How is the well lined? How is water raised to the surface from it? Inquire whether or not the water has been tested by health authorities and certified as fit for human use. What is the relationship of such a well to the water table, as you have learned about it?
4. Visit another well that is drilled rather than dug. How does it differ from the open one visited? Does it differ in depth? What is the relationship of the drilled well to the water table? How is the water brought to the surface from this well?
5. Visit a lake that is used as a reservoir for the water supply of an urban community. Learn its area, and approximately how much water it impounds in normal conditions. Learn the area of its watershed and the length of its shoreline. Does this water qualify for use as fit for human consumption, or does it have to be treated first? If the latter, visit the water treatment plant and learn what is done to make the water fit for use. Is the lake also used for fishing, waterfowl hunting, swimming, boating, and skiing?

Possible Outcomes:

1. A realization that water occurs naturally in the air, on the surface of the earth, and below the earth's surface.
2. An understanding that all these locations contribute to our usable supply of water.

7. CONCEPT: FLOODS RESULT FROM SURFACE WATER RUNNING OFF TOO RAPIDLY.

Discussion: As the concept states when surface water runs off too rapidly it is likely to get out of control. The result is the beginning of a flood. Especially is this true if the rainfall is continued beyond the immediate needs. The discussion of this concept at the primary level dealt with the harmful outcomes of floods. It is now logical to ask, why floods get started anyway? Why doesn't enough rainfall soak into the soil that there isn't a small enough fraction left to run off that it won't start a flood.

The answer lies primarily in how the soil is covered. If the soil is covered by forest, grass, or close-growing field crops, a much larger portion of the falling water will be absorbed into the soil. In the forest, the trees with their spreading limbs and leaves will break the fall of the rain making it strike the ground much more gently. The litter on the forest floor will help to lead the water into the soil permitting less of it than otherwise to run off. If the falling rain encounters grass sod or close-growing crops, the roots of the vegetation make the soil much easier for the water to enter leaving far less to run off. A similar effect is found where the soil is covered with dead or dry litter such as straw or dead grass. The rain is allowed more time to be absorbed by the soil before any of it begins to run away.

In any of these cases, such water as does start to run off is far less likely to do harm to the soil because it will be clear as it runs rather than muddy and will have much less cutting ability as it goes. Thus, less soil erosion will result.

It is not difficult to picture the converse of these conditions. Suppose the hills have been denuded of forests, the sod has been plowed, and the farmers' fields are bare of cover crops. Under such conditions wet seasons will invariably bring flooding.

Suggested Activities:

1. Use three ordinary quart jars with caps. After a heavy rain, fill one jar with the muddy water running off from a cultivated field, the second jar from a rill running off from woodland, and the third from a stream running from well-sodded pasture or meadow. Cap all the jars, label, and set them in the classroom for observation. Allow the jars to remain undisturbed for a few days. What differences can be seen when the water in each has thoroughly cleared? In which is there the most sediment? Of what does this consist? Where did it come from? Does it hurt the farmer who owned the field to lose this? Why? Where would this sediment normally have been deposited? Would it possibly hurt some one there?
2. Pursuing the idea of flood water carrying soil as it runs off, consider these questions. (Some research into published literature may be needed to answer them.) Suppose the sediment were deposited in a lake built to produce hydroelectric power. What would be the result after a few years? If the sediment reaches one of our major rivers where a harbor exists at the river's mouth, what effect will result to the harbor? (Consider New York harbor, or New Orleans.) What effect does heavy sediment have on fish that live in a stream or lake? What effect does the deposit of sediment in a stream bed have on the water-carrying capacity of the stream? How would this affect future floods? Learn the amount of sediment carried past New Orleans daily

by the Mississippi River, in terms of farm land. Where has all this soil come from? Draw conclusions in terms of soil erosion and its manifold effects. Where would the attack on this evil be started? When?

Possible Outcomes:

1. A realization of the variety of damage resulting from rapid run off of excess surface water.
2. Further understanding of the wide extent of damage and possible suffering accompanying floods.

8. CONCEPT: WATER CAN BE POLLUTED IN MANY WAYS, EITHER BY MAN OR NATURAL FORCES.

Discussion: Water pollution is far more common than is generally realized. Around urban areas it is difficult to find lakes, rivers, harbors, or even small streams that have not been contaminated with some kind of polluting materials. Industries are the most numerous agencies of pollution. Industrial wastes can be as varied as the products of the industry. Steel mills, paper mills, meat packing houses, and all other kinds of industrial establishments have some waste products to dispose of, and far too often such wastes are discharged into nearby waterways. Many urban settlements discharge sewage into streams. If the sewage is incompletely treated to kill all organic matter in it, it is a severe source of pollution.

Water pollution is not necessarily confined to fresh water bodies. Sea water near where large streams discharge their currents may become polluted by the contents of the river to the extent that oysters grown on shallow sea bottoms near shore may be unfit for human food. Offshore petroleum production can pollute sea water to the point of killing oysters, shrimp, and many fish in nearby waters.

Even rural areas are not exempt from water pollution. The farmer's well water may become unfit for use if drainage from septic tanks, barns, or dairies is allowed to seep toward the well. Small streams on or near a farm are too often used as dumping areas for waste materials of various kinds that render the water unclean.

Natural forces sometimes are responsible for water pollution. Floods nearly always make water supplies in flooded areas unfit for use and residents are warned to boil all water for drinking purposes. Floods may also make streams and lakes so muddy that fish and other aquatic animals either die or have to leave the area. Tidal sea water running before storms often invade land areas of low elevation and make water areas so salty that vegetation and crops die from its effect. All these are illustrations of pollution.

Students should learn proper respect for water bodies. They should also learn the importance of having all water supplies checked for purity by health authorities at regular intervals.

Suggested Activities:

1. Fold a piece of filter paper and place it in a glass funnel. Pour some muddy water through it. Examine the filtrate. Is there any trace of mud? In the same way, filter some muddy water that has salt dissolved in it. Again examine the filtrate. Is there any trace of mud? Taste the filtrate. Why did the filter remove the mud but not the salt? Consider the difference between solution and suspension. Draw conclusions.
2. All disease germs and many other forms that pollute water are living organisms. To test water for organic pollutants, add a few drops of sulphuric acid to a sample of water in a test tube. To this add crystals of potassium permanganate until the water is colored (purple). Heat gently until the water boils. If the color remains, there is no organic matter present. If the color fades or turns brown, there is organic matter in the water sampled. Consider the element of safety of such water for home use. Can such contamination be detected by appearance?
3. Fill a test tube half full of lime water (dilute calcium hydroxide). Add about ten drops of soap solution (not detergent) and shake the tube thoroughly. Notice that a scum has formed at the top of the water. This denotes mineral content. It is the same sort of thing that causes a ring in the bathtub when we bathe. Such water is called "hard" water and is quite safe for human use. It is not, however, good to use in steam boilers because it coats the inside with a mineral deposit that requires more and more heat to make the steam.
4. Make a survey of your community to learn whether or not there is any considerable pollution of water in it. Determine what treatment is given the sewage in your city before it is discharged. Visit all the industrial plants there to learn how they dispose of their waste products, and whether or not they make them harmless before such disposal. Inquire at the local slaughter houses to learn how they dispose of blood and animal wastes. Check streams and lakes for mud from soil erosion. Summarize your findings. Consider writing an article for the local paper telling the result of your research.

Possible Outcomes:

1. Further understanding of the various types of possible pollution of water.
2. An understanding of dangers that accompany using water that may appear clean but really isn't.
3. Some concept of possible bad practices in the local area regarding disposal of wastes.

9. CONCEPT: WATER PROVIDES MANY TYPES OF RECREATION.

Discussion: Modern life puts considerable premium on recreation facilities. In this day of short working weeks, paid vacations, and more leisure, the possibilities for recreation are becoming more important each year. Another factor that increases the importance of recreation facilities is the spiraling migration of rural residents to urban centers.

Water bodies have always been favorite areas for recreational activities. This is especially true in the warmer months and in the milder climates. A good example can be seen on any summer weekend on a bathing beach along any seashore or lake shore that is near a metropolitan center. The swarms of people testify to the need and desire for opportunity to escape the humdrum routine of daily city life to enjoy a break from the monotony.

Many types of recreational activities center around water bodies. Swimming, boating, and skiing are among the most popular. Fishing is a sport that is popular in all seasons. Hunting of waterfowl is seasonal and limited to open seasons on the particular birds being sought.

Camping is a form of recreation that is becoming more popular each year. Although water bodies are not necessary for camping, the presence of water usually makes a campsite more attractive. Campers seem to prefer locations where water bodies are bordered by forests.

Suggested Activities:

1. List the places in your community where water-oriented recreational activities are possible. Make a similar list for your parish. Then make a similar list of the places outside your parish but still in Louisiana that have been visited by members of the class and/or their families. On an outline map of Louisiana show the locations of all such areas listed.

2. Make a list of safety rules that should be observed by everyone when fishing (from bank or boat), boating, swimming, skiing, or hunting waterfowl. Make another list of rules that should be observed by campers. Include in the latter rules that pertain to both safety and good manners.
3. Make a collection of postcards showing scenes of water-oriented recreation in different parts of Louisiana. Many such scenes can be obtained from other classroom groups by entering correspondence exchange with them. Make a bulletin board display of cards finally collected. (Such correspondence would offer excellent opportunity for exercises in letter writing.)
4. Invite some qualified person to visit the class and to demonstrate safety measures that should be observed in all water-oriented sports.
5. Secure a copy of the hunting laws of Louisiana. Note especially those that concern the taking of migratory waterfowl species.
6. Organize a "Pole Club" in your school. This is simply a group of students and teachers who enjoy fishing with cane poles. Field trips by such a club are quite inexpensive and quite rewarding. Establish both safety and sanitary rules to be observed on such excursions.
7. Have the students consider reasons why people need to indulge in recreational activities. Take into such consideration conditions resulting from rural-to-urban migration, short work weeks, paid vacations, increasing leisure time, and easy mobility of family groups.

Possible Outcomes:

1. Further understanding of man's present-day needs for recreation.
2. A better acquaintance with recreational possibilities of natural areas in local, parish, and statewide dimensions.
3. Establishment of elementary desirable habits for using recreational facilities also available to others.

10. CONCEPT: THERE ARE MANY WAYS TO CONSERVE SOIL AND WATER.

Discussion: Soil and water are so intimately associated that their conservation is nearly always considered together. Soil without water is unproductive, as is the case in a desert. On the other hand, while water is necessary to make soil produce food, it can be the cause of great losses of soil if it is allowed to get out of control.

The two great principles of soil conservation include the protection of soil from erosion caused by wind or water, and the maintenance of its fertility. The latter means protecting the soil from depletion of the important mineral nutrients that are so important to the growth of plants, and in turn to the animals and man who eat the plant products.

Soil erosion by water is most likely to be a problem where the soil surfaces are sloping. Erosion will not occur in any great quantity if the soil is kept covered with growing vegetation. But many food and fiber crops demand the plowing of the soil for their production. Under such circumstances man has devised several practices that permit such use of the soil and, at the same time, reduce water erosion to a minimum. These include building terraces on the contour of the slope. Such structures slow running water to a "walk" and lead it into sodded run ways where it does little or no harm. Another practice that is profitable is planting row crops on the contour of the slope. This device uses every row of the crop as a small terrace that helps to slow water runoff. Strip cropping is another practice that takes advantage of the contour idea. In this method fairly wide (depending on the degree of the slope) strips of row crops are alternated with small grains or hay crops that grow close together and are not cultivated. The close-growing crop has the effect of acting like a terrace and helps to slow the course of water answering the pull of gravity. Of course if the slopes are too steep, the soil should not be broken at all but should be devoted to forests or well-sodded pastures that should be carefully not overgrazed.

Erosion of soil by wind is more likely to be a problem in flat lands than in areas where the terrain is rolling. Such erosion occurs only in dry seasons. The principal defenses against it are keeping the soil covered with vegetation and planting windbreaks of trees perpendicular to the direction of the prevailing winds.

Proven conservation practices that protect soil from depletion of the elements of soil fertility include the rotation of crops which put different drains on the various soil nutrients and generally include at least one year of growing legumes that are capable of taking nitrogen from the air and converting it into a form plants can assimilate. Any method of increasing the organic matter in the soil increases its fertility. Plowing under green crops, or dead vegetable material will add humus to the soil. Spreading and plowing in barnyard manure is also a desirable practice. Sometimes mineral matter must be added to soils in the form of commercial fertilizers. Also, the addition of crushed limestone not only supplies calcium that is often in short supply, but also corrects acidity in "sour" soils and makes all minerals more easily available to growing plants.

The supply of water remains fairly constant. The problem that requires attention where its connection with soil is concerned is for the supply of soil water to remain adequate during the season of growing crops. This doesn't always happen. To conserve the supply of soil water it has been found profitable to maintain a mulch on the surface of the soil where crops are being produced. Either a mulch of dried vegetation or a dust mulch will retard the evaporation of needed water from the soil. Where possible, when the natural supply of water becomes inadequate, irrigation is practiced. This process requires a source of water either underground, tapped by wells, or an available stream or reservoir from which needed water can be deflected by gravity or pumped as may be necessary.

The conservation of water for other needs than agricultural ones, involves the prevention of silting of reservoirs, destruction of impounding dams by flood, and protection of water from pollution. Watershed programs of soil and water conservation have proved to be profitable in all their results.

Suggested Activities:

1. Arrange for a field trip for the class to observe some soil conservation practices that are customarily used in your community. Your parish agricultural agent or parish soil conservationist can recommend some farmers whom you may contact for visits. Try to find (for the students to observe) such practices as terracing of sloping fields, contour cultivation, strip cropping, and use of winter crops for soil protection and green manure to be plowed under in the spring. Learn from the land owner the purpose of each practice.
2. While on the visit described in No. 1, inquire of the farmer concerning his rotation plan for crops, and the reasons for such a plan. Learn, also, how he manages his soil to replenish mineral nutrients that are used by the growing crops. Learn what fertilizers he uses and why. Inquire as to their cost and how profitable their use has proved to be.
3. Invite your parish agent or a soil conservationist to visit the class and talk about soil conservation in your community, its purposes, and success.
4. As a language exercise, have the students write two stories--one on "How water is slowed to prevent soil loss in this community" and one on "How the soil in our community is kept in a productive condition".

5. Visit places in your community where (1) artificial drainage has been provided to prevent soil remaining too wet and, (2) irrigation must be used during dry seasons to produce profitable crops. In each case, learn the approximate cost of the provision and how profitable the investment has been. Learn the basic principles involved in both practices.
6. Soil erosion by wind is not an important problem in Louisiana. Learn from books and pictures where it is troublesome and what practices are used to combat it.
7. Through class discussion and possible questioning of an expert, learn in how many ways soil conservation is closely related to water conservation. For example: learn how drainage of excess water improves soil and its productivity, and how proper management of soil may reduce the need for irrigation.

Possible Outcomes:

1. The ability to state in elementary terms several principles of soil and water conservation.
2. Basic understanding of what such principles mean in terms of the responsibilities of every citizen and for the good life of everyone.

JUNIOR HIGH SCHOOL

1. CONCEPT: CIVILIZED MAN'S PROGRESS DEPENDS ON SOIL.

Discussion: Early man spent his time finding food for his subsistence. At best, his was a hand-to-mouth existence. His first mark of progress came with his discovery of how to manipulate soil to provide food when and where he wanted to stay. Another great stride was achieved when he learned to produce more food than he needed to subsist. Then, he could give some time to the development of some of what we might call culture.

Throughout history the building of the outstanding societies and cultures have been accompanied by man's discoveries and inventions of improved ways of using the soil for food production. Conversely, most of the declines of highly developed cultures have resulted from catastrophic changes in the productivity of the soil in localized areas. Examples are ancient China, Carthage, Rome, Egypt, and others. In modern times, the great nations are those that have been most successful in producing foodstuffs from their soils. The backward nations of today are those in which hunger is rampant and where food production is never adequate to support the people.

Most of the world's great works of art, music, and literature have been produced in countries and time periods where and when the soil has been most productive of food and the energies of many of the people could be exerted in other directions than mere subsistence. Great economic and technological advances have in the past and at present appeared in nations where the soil has been well treated and a small fraction of the populations are able to support many more than themselves with the necessities of life and living. Someone has said that "All wealth can be traced ultimately to the soil." While that might be difficult to prove, the idea is not without much foundation. If the history of civilization is carefully considered, the heights of culture and achievement cannot be divorced from the conservation and wise treatment of the soil.

Suggested Activities:

1. Show slide talk "Grass and Conservation in Louisiana," and "The Story of the Land," available from Soil Conservation Service, Alexandria, Louisiana; or invite a Soil Conservationist to present the talk.
2. Use your reference library to find out how the Food and Agriculture Organization of the United Nations is aiding areas which experience poor agricultural yields.
3. Through research means, try to learn the stories of the catastrophies that overtook, and brought about the decline of ancient cultures in Rome, China, Carthage, Egypt, etc.

Possible Outcomes:

1. An understanding that a nation's culture can develop only after a food supply is assured.
2. An understanding that since soil provides food for subsistence, it is basic to development of civilization.

2. CONCEPT: THE TOPSOIL TEEMS WITH LIVING PLANTS AND ANIMALS--MANY KINDS TOO SMALL TO SEE--THAT HELP TO FORM IT.

Discussion: One writer has stated that "There are more forms of life in the soil than there are above it. A pound of fertile topsoil may contain more organisms than there are people on the face of the earth." This statement should emphasize the tremendous number and variety of living things that inhabit the topsoil.

Another authority analyses the organic material in productive topsoil by stating that in a cubic foot of such soil there are two pounds of organic matter and that, at any given time, one pound of it is dead remains of what were living things, while the other pound is made up of organisms very much alive. The living part consists mainly of plant roots, bacteria, earthworms, fungi, algae, tiny round worms, with other species in lesser quantities. About one-third of this pound is made up of roots of living plants, that would measure collectively several miles in fertile topsoil. These root hairs feed from the surfaces of the soil particles. This sounds like an imaginary quantity of root hairs in only one cubic foot of good topsoil, but it should be noted that the surfaces of the soil particles in this amount of good sandy loam would, if spread out flat, cover an area of about a thousand acres or more than one and one-half square miles.

Besides the larger plant roots, the only other organisms visible to the naked eye are probably the earthworms which this same writer says occur to about one-third the weight of the roots. Bacteria make up about twice the weight of the earthworms or two-thirds the weight of the plant roots. The remaining four-tenths of the pound of living organisms include all the others.

It should be noted that the organic matter, both living and dead, in the topsoil marks the principal difference between that layer and the subsoil. It is this difference that makes possible to a large extent the production of food. The depth of the topsoil is sometimes referred to as the distance that man lives from a desert. Organic matter in soil is a storehouse for nitrogen without which plants won't grow. It also hold the supplies of other nutrient elements that give quality to foods produced from the soil. Organic matter in soil helps it to hold the water plants must have for growth, although excess water drains better from soils rich with organic matter than from soils with little humus.

Wise use of the soil includes constant renewal of the supply of humus. Good farmers practice this by plowing into the soil all parts of the crop plants not gathered in the actual harvest. An even better practice is plowing into the soil green, growing crops of such plants as legumes that are able to take nitrogen from the air and to fix it in forms green plants can use.

Suggested Activity:

1. Take three heavy paper bags such as shopping bags or doubled brown paper bags (one inside the other), a small spade, and a measuring tape. Collect samples of topsoil as follows: Measure one foot square and dig out the soil to a depth of two to three inches and place in a bag, (1) from under the litter on the floor of an ungrazed, unburned forest, (2) from under the grass in a good pasture or fence row (preferably the latter), and (3) from under any plant growth in a badly eroded area where subsoil is showing. Take the soil samples back to the classroom where they can be examined free from wind. Have ready six or more clean, clear glass bottles that can be stoppered. Pour the contents of bag (1) on a clean piece of white paper about three feet square. Sort or sift the soil to discover live animals in it. Place the forms of animal life in separate bottles. Look for examples of (a) earthworms, (b) grubs--worm like but with legs, (c) snails--with shells or without (called slugs) (d) insects--ants or beetles--anything with three pairs of legs, (e) spiders, mites, or ticks--four pairs of legs, (f) creatures with more than four pairs of legs, (g) any that don't fit either category above. Count the different forms of animal life visible to the eye and collected. Also, see how many portions of plant roots can be found in the sample.
   Repeat the process with each of the other two soil samples. Does the amount of living organisms seem to have any relation to the looseness of the soil? Could it have a relation to the ability of the soil to absorb water? Could it have any relation to soil fertility? Learn from books the comparison of visible forms of life in the soil to those forms that can't be seen without magnification. How do the findings in the different soil samples compare? Does this bear out the usual feeling about the fertility of different soils? Could the popular opinion be well founded?

Possible Outcomes:

1. A realistic concept of the importance of organisms and organic materials in the soil.
2. An understanding of how living things help to form and to improve soil.

3. CONCEPT: LOUISIANA HAS MANY TYPES OF SOILS, EACH OF WHICH HAS ITS BEST USE AND ITS LIMITATIONS.

Discussion: The teacher is advised to procure a map showing the various soil regions of Louisiana. Such a map can be obtained from the Soil Conservation Service in Alexandria or from Agricultural Extension Service at L.S.U. A soils map of the State will show much more detail than the children need to study, but it can be used to show the principal soil belts within the State at least. Attention should be given to the broad band of alluvial soil that borders the Mississippi River all the way through the State. This and the narrower band of Red River alluvial soil are probably the most productive soil areas of Louisiana. Much of the Florida parishes and most of the northern and western areas of the State are covered with lighter, sandier soils that are typical of the hilly regions. These soils are less productive for cropping and need to be well protected from erosion. Along the coast is a broad band of tidal marsh land bordered inland with a wide belt of coastal prairie which is also a fertile, productive type of soil.

Soils differ widely in fertility. This is the characteristic largely responsible for a soil's productiveness. Occurrence and quantity of organic matter is an important factor in the fertility of a type of soil. In addition to this, the quantities of the various mineral nutrients present may determine a soil's suitability for production of certain food crops. Such a limitation may, however, often be overcome by adding to the soil a commercial fertilizer strong in the substance in which the soil, itself, is inherently weak. Fertilizers are composed of certain chemicals that supply particular plant foods in available forms. For example, if a soil were deficient in available phosphorus, it might be made suitable for a crop that requires much of that element by treating it with ammonium phosphate. This fertilizer is rich in phosphorus that plants can use and also supplies an additional amount of nitrogen. The use of commercial fertilizers has proved to be a profitable practice in the use of many types of soil.

It is also worthy of note that soils differ in color. Color, as such, is not an important characteristic of soils, but it may give indications of the type of parent material from which soil was derived, how far a soil may have been transported before coming to rest where it is seen, the amount of organic matter it may contain, or its ability to hold moisture. All of these are important characteristics of soil types.

One of the most important things to learn about types of soils is that each has a best use. Wise use of soil requires that it be used for a purpose that will yield best results and, at the same time, protect the soil for continued use. Teachers should call on county agents, local soil conservation representatives, or other such experts to provide information on the best kinds of use to make of different types of soil occurring in local areas.

Suggested Activities:

1. Secure a map of the soil regions of Louisiana from the Soil Conservation Service at Alexandria or the Agricultural Extension Service at L.S.U. Study it. Identify the chief soil regions of the State. Discover the principal type of soil that occurs where you are located. What are its principal properties? Would this information indicate that all the soil in your community is of the same type?
2. Explore the community in which you live. Are there different types of soil to be found there? If so, collect samples of them. Examine such samples for differences in appearance (color), feel (texture), and content. To determine the last (content), examine with a magnifying lens. Look for particles exemplifying sand, silt, clay, organic matter. Draw conclusions. Test the different samples with litmus paper. Do they vary in acidity and alkalinity?
3. Investigate fertility of the soil. Fill one flower pot with rich garden soil and another with pure sand. Plant a fast-growing seed like nasturtium in each. Place in the sunlight and keep watered. Observe differences in growth, if any.
4. Cut both ends out of several metal soft-drink cans. Tie a cloth securely over one end of each can. Take samples of soil from different locations, such as forest floor, under sod in a pasture, a cultivated field or garden, an eroded area where much topsoil has been lost, a low, flat area, and a steep hillside. Dry all soil samples with slow heat until they cease to lose weight. Pulverize each sample thoroughly. Put equal measured amounts of different soils into the metal cylinders covered at one end. Support the cylinders (covered end down, of course). Now pour equal measured amounts of water into each container of soil. Observe to find which soil absorbs water fastest and lets it drip through first, second, etc. Carefully catch all drips. After all dripping has ceased, measure the amounts of water that filtered through each sample of soil. How do the samples differ in ability to absorb water? To hold water? Why is each ability important?

5. Invite a soil conservationist or your county agent to visit the class and discuss using each type of soil to the best advantage.

Possible Outcomes:

1. An understanding that there are several types of soil in most communities and that there is a best way to use each type.
2. A realization that soil types vary in ability to absorb and to hold water, and in fertility.
3. A general understanding of the wide variety of soil types to be found in Louisiana.

4. CONCEPT: EXPLOITATION AND DEPLETION OF SOIL HAVE CAUSED CHANGES IN ECONOMIC CONDITIONS.

Discussion: In the early history of our country the people seemed to feel that the natural resources would last forever and that no thought needed to be given to how they were used or exploited. This idea was extended to the use of the soil as well as other resources, and farmers rarely made attempts to keep their fields producing sustained yields. Rather, they would wear out a farm and move on to new land, there to repeat the whole process. This cycle persisted until there was no new land to be settled.

The wearing out of the soil consisted of subjecting it to continued erosion and also depleting it of those nutrient elements necessary for the production of food crops. These include things like nitrogen, phosphorus, potassium, calcium, magnesium, and sulphur. Extensive erosion not only causes sufficient loss of soil to reduce the quality of living that man can make from the land, but may also bring about conditions that are costly--even disastrous--in other ways. Great movement of soil downstream in a watershed can kill fish in streams, deposit layers of sand in low lands that completely ruin fields, and fill with silt reservoirs that supply great cities with water. Unchecked gully erosion may undermine houses, cause land slides, and in other ways ruin a community. Roads and railroads may have to be relocated. Any such changes are economic disasters from which communities recover very slowly and at terrific expense.

Soil depletion may so reduce the productivity of the soil that the whole economic structure of a community may have to be changed much the same as the change that overtakes a sawmill town when its supply of standing timber is exhausted. Farming becomes marginal, many families move away to more promising areas, businesses close their doors, and even banks fail. In short, the communities become "ghost" towns, and all because the soil has been misused. Such conditions can be identified in practically every part of our country but perhaps more in the eastern states than in other regions.

Proper soil conservation practices could have prevented such occurrences, and even after the damages have been done, with adequate work and investment can be overcome. The soil is a renewable resource and can be restored to a high per cent of its productivity with suitable treatment.

Suggested Activities:

1. Invite a soil conservation expert to visit the class to discuss how exploitation and depletion of soil can cause changes in the economic conditions of a community. While he is there ask him to recommend to the class two farms where (1) good soil conservation practices may be observed and (2) where little or no such practices are being followed.
2. Arrange with the two farmers cited by the speaker in No. 1 for the class to visit their places to observe the differences in the treatment of the soil on the two places. Have the class attempt to evaluate the comparative success of the different farm enterprises.
3. Have a panel discussion on the subject "Poor soil makes poor communities."
4. Hold a debate on the subject: "Resolved: that only the farmer and his family have any interest in how the soil is treated."
5. From research in published material learn why poor soil raises only poor food, and poor animals. Also try to discover why the average depth of the topsoil in America is only about half what it was when white men first settled its shores. Further, explore other kinds of disasters that may follow exploitation and depletion of soil.

Possible Outcomes:

1. An understanding of the long range consequences of abuse of the soil.
2. A realization that soil conservation is as important to the urban dweller as it is to the rural inhabitant.

5. CONCEPT: WATER IS VITAL TO ALL PLANT AND ANIMAL PROCESSES.

Discussion: Neither plants nor animals could live without water. It is basic to all the life processes of both. Green plants absorb water from the soil, transport it up through the stems by means of osmosis and capillary action to the leaves, where they combine it with carbon dioxide from the air to form simple starch, the basic food for both plants and animals. This starch may be changed by the plant to sugar, protein, or fat by later changes. Whatever food may be the final form the plant produces, all minerals or other nutrients included must be absorbed by the plant in water solution. Furthermore, whenever a plant moves manufactured food from the leaves to wherever it is to be stored, that food must be in water solution to be transported to roots, stem, seeds, or fruit. Thus, water is the medium for all plant processes, including absorption, transport of food, or growth. Growth in plants results from the moving of manufactured food from the leaves to the mitotic tissue where new cells are formed. A plant could neither grow nor just continue to live without water.

Animals are as dependent on water as are plants. Just as the sap in plants is mostly water, so the protoplasm of all animal cells is mostly water and is necessary for all body processes. It is the medium that carries the enzymes in all the different digestive juices. Without water the animal could not digest food. Water is the chief constituent of blood plasma, so the animal would have no medium of circulation without adequate water. Equally important to animals is the matter of the disposal of body wastes. Carbon dioxide, the chief waste product resulting from oxidation of food in the ultimate body cells, is excreted by the lungs in breathing. But it must be transported to the lungs by the circulating blood. Other body wastes are mostly excreted in urine which is largely water. Even solid body wastes are helped on their way to excretion by intestinal fluids that are made up mostly of water. Most warm-blooded animals use water to regulate their body temperatures. This is the process of perspiration.

Suggested Activities:

1. Find a detailed diagram of a plant showing roots, stem, branches, and leaves. Have the students study it and trace the course of soil water from its absorption to where it is used in manufacture of food, and the excess transpired. Make a list of common food-producing plants and show by each in what part the food is stored. Make diagrams of some to show how the food material is transported from where it is made to where it is stored.
2. From books learn the percentage of water in the total composition of (a) the human body, (b) milk, (c) fresh meat (such as beef steak) (d) cured

meat (such as ham), (e) fresh vegetables (such as lettuce or cabbage), (f) fresh fruits (such as tomatoes or strawberries), (g) dried fruits (such as prunes or raisins), etc.

3. Weigh some dehydrated foods as dried apples, dried peaches, dried potatoes, and the like. Soak in water overnight. Drain and reweigh. Compute the percentage of gain in weight for each.
4. Attempt to explain what really happens in such phenomena as (a) curing of hay, (b) ripening corn, (c) change in color as such grains as wheat, oats, or rye ripen. Find other such examples and include them too.
5. Have a contest in the class to see which of two students can eat more crackers without drinking water. What does this show regarding the importance of water to our swallowing? Consider water's importance in other body functions such as digestion, circulation, perspiration, excretion of wastes, etc.

Possible Outcomes:

1. More understanding of the necessary function of water in all plant and animal processes.
2. An understanding of how many commercial types of food are processed.

6. CONCEPT: OUR SUPPLY OF WATER IS RENEWABLE, BECAUSE OF THE WATER CYCLE.

Discussion: As was pointed out in the discussion of Concept 6 for primary pupils, the greatest part of the water in the world is in the oceans. Our consideration of the water supply must be limited to available fresh water. Fortunately there is a fairly fixed amount of fresh water always available. We speak of the supply of water being renewable, and correctly so, because the water vapor that evaporates from the surface of the great ocean areas leaves all salt and minerals in the sea as it enters the air in vapor form. When the winds (or moving air) carry this vapor over land areas and it cools to the point of condensation, the water that falls as rain or snow contains no mineral solute except possibly some dust that it took from the atmosphere as it fell.

Thus, fresh water that escapes to the sea returns to land areas by means of this evaporation-condensation cycle that renews the supply of fresh water available to the animals and plants that live on land. This is part of the water (or hydrologic) cycle that is going on all the time. Other parts of it find rain falling on land areas, with parts of it being absorbed by the soil and remaining in and under the soil for a long time, other parts being returned to the atmosphere as vapor transpired by the leaves of green plants, while still other parts evaporating from the soil or from surface water bodies or streams.

A good diagram of the water cycle should be found to be studied by the students at this level. The understandings to be gained from such study are fundamental and should be perceived before the students are any older.

In many parts of the country, water is secured from underground sources that are accompanied by considerable pressure caused by gravity. These are called artesian wells. If such wells are left open to flow all the time, much water is wasted and the level of the underground water table is being unnecessarily lowered. Such wells should be equipped with valves that would permit their being closed when the water is not needed. Unchecked flow is waste.

Suggested Activities:

1. Find a comprehensive diagram of the water cycle. (Be sure it includes plants and shows their parts in the whole scheme.) Have the students study the diagram at length. Find answers to such questions as: What are the sources from which water vapor reaches the air? What moves water vapor from place to place? Under what conditions does water vapor condense into liquid form? Into solid form? How does snow differ from rain? How is hail formed? How does the water cycle as a whole, explain the statement, "Our water supply is renewable."
2. Study a series of ten to fifteen consecutive weather maps for continental United States. Note the areas of low pressure (cyclones) and areas of high pressure (anti-cyclones). Which kind of whirl causes clockwise winds? Counter-clockwise? What are "prevailing westerlies?" Learn why deserts and arid regions in America are always east of high mountain ranges. Try to explain why rain in Louisiana usually follows a period of southerly winds. How is rainfall, in general, dependent on the succession of cyclones and anti-cyclones in North America?
3. Learn how a rain gauge works. What is meant by a rainfall of "one inch"? When one inch of rain falls, how many cubic inches of water fall on each square foot of soil? (144 cu. inches) If this represents approximately five-eighths of a gallon and there are 43,560 square feet in one acre, how many gallons of water fall on an acre in such a rain?

4. On an outline map of Louisiana note the rainfall of various parts of the State. What is the annual rainfall for the area in which you live? For your area, compute the weight, in pounds, of water that falls on an acre of land in a year of average rainfall. (Water weight: 62.4 lbs. per cubic foot.) How many tons would this be?
5. Visit an artesian well if there is one available. From diagrams to be found in earth science books or an encyclopedia, explain what makes such a well flow. Is there a stop valve on it that will permit its flow being stopped? If not, do you think there should be? What effect would a constantly flowing well have on the water table? Would this be a form of waste?

Possible Outcomes:

1. An understanding of the water cycle and its importance in the world's water supply.
2. An understanding of weather as it relates to rainfall and the water supply in any given area.
3. A perception of the effect of topography on average annual rainfall.

7. CONCEPT: TO A LARGE EXTENT, FLOODS CAN BE PREVENTED OR CONTROLLED.

Discussion: Under Concept 7 for the primary and intermediate levels we have seen the ways floods cause damage and how they get started. Junior-high-school students are mature enough to consider how floods can be prevented and controlled. It should be understood at the outset that flood prevention does not encompass natural disasters. There is no defense against such hazards as followed hurricanes Audrey and Betsy in Louisiana, or Beulah in Texas.

Prevention of ordinary floods should begin at the upper levels of a watershed (area drained by a given stream). When small streams overburdened with runoff water come together the danger increases for all points downstream from their confluence. If the small overflows can be checked at their beginnings, little likelihood of floods would develop. The program of Watershed Flood Control developed by the U. S. Department of Agriculture was designed for this particular purpose. It consists of building small dams across small drainage ways to create small reservoirs that will hold enough runoff to keep a young flood from developing. As it has been practiced, the program is a cooperative one and requires teamwork between all land owners in the area, their local organization, and the government. It is supervised by the Soil Conservation Service.

Much information can be obtained about the program from the S.C.S. or from local representatives of the Agency. It is also a significant activity in the prevention of soil erosion and for that reason is doubly important.

Less organized influences that help to prevent incipient flood conditions include discouraging the denudation of forested hills, keeping fields covered with growing crops all year round, and any other practices that will "cause running water to walk". In other words, the general idea is to slow the runoff of excess rainfall.

Along larger waterways that carry the runoffs of many tributaries, flood control has largely become a problem for the U. S. Army Engineers. This is because it is recognized as a national rather than a state responsibility. Large waterways, such as our major rivers are usually bordered by high, strong levees that confine the overloaded streams to their natural courses. To relieve the pressure on the levees in times of unusually high water, floodways have been prepared so that by opening spillways in the levees, large amounts of the flood waters can reach the sea by short cuts. Two such spillways have been constructed in Louisiana for the relief of the levees on the lower Mississippi River. The Morganza Spillway is designed to let much water flow to the Gulf through the Atchafalaya Floodway, while the Bonnet Carre Spillway permits water to reach the Gulf through Lake Pontchartrain. The latter has been used several times but, so far, the Morganza Spillway has not been opened.

Dams have been constructed on several of the major tributaries of the Mississippi, like the one on Red River that forms Lake Texoma along the Texas-Oklahoma border. This holds some of the potential flood water on such a stream until much of that below the dam has had time to pass out of the way.

Suggested Activities:

1. From literature available from the S.C.S. learn what a Watershed Project is. Study a map of one that has been completed. Invite a S.C.S. agent to speak to the class about such projects. If there is a completed Project of this type any where near the school, try to arrange for a field trip for the students to observe it directly. What are the two basic purposes of such an enterprise?
2. As a language exercise write an essay on some such subject as, "How a Watershed Program Gave New Life to a Community."
3. Invite some older person to visit the class and to describe his or her experiences in major floods of 1927 or 1945 in Louisiana.

4. From published materials learn what has been done by the U. S. Army Engineers to control floods in Louisiana from the great Mississippi River system. Try to arrange a visit for the class to the flood gates of the Morganza, Atchafalaya, or Bonnet Carre spillways, or the Wax Lake Outlet. Trace these safety plug spillways on a map of Louisiana. Consider the present possibility of a recurrence of conditions that developed in Louisiana during the 1927 great flood.
5. Consider again the practices that are included in a Watershed Project. Which of these several practices could and should be used by land owners even in the absence of an organized Project. Would they serve to help accomplish a desired end by "making running water walk"? Would they be profitable to those who used them? Would anyone else be benefited? (Such practices as growing trees on steep slopes, constructing terraces, contour cultivation, use of cover crops, and strip-cropping should certainly be included. Also, avoidance of denudation of forested hills.)

Possible Outcomes:

1. An understanding of the basic principles of flood prevention.
2. An overview of flood control measures that have been prepared in Louisiana.
3. A fairly mature realization of the inter-relationship of soil erosion control and flood control.

8. CONCEPT: POLLUTION OF WATER CAN BE CONTROLLED AND CORRECTED.

Discussion: Water pollution has become a nationwide problem. Most of the states have enacted legislation designed to correct it, but many of the laws are difficult to enforce. In recent sessions, the Congress has enacted laws to protect from pollution waterways that cross state lines into other states. The problem is being widely recognized and attacked.

Industries are being required by law to neutralize acid and alkaline wastes before discharging them, and to make harmless any salts contained in their refuse. Packing houses are required to cook into harmless condition all blood and waste parts of animals being slaughtered before the waste materials are disposed of. Cities are being required to cease all discharge of untreated sewage before permitting it to enter any drainage system. Oil fields and coal mines are now required to neutralize all waste waters before they are released.

Such laws are good, but only as good as the results that they bring. Some are insufficient and need to be amended. Some are poorly enforced, so the problem remains unsolved. Not until an adequate number of inspectors can be employed who will be rigid and unbiased in their law enforcement will the matter of water pollution become a condition of the past.

When such conditions prevail, our streams will again be filled with fish, waterfowl can alight on our lakes without having their feathers fouled with floating oil and fats, children can swim in the "old swimming hole", and public beaches can be used for recreation and refreshment without danger of disease epidemics.

It should be noted, however, that legal restrictions and regulations are not enough in themselves. Private citizens and industrial managers must be educated to the desirability of keeping all our waters clean. Everyone needs to develop the attitude of protecting water, whether surface or underground, free from any kind of contamination that would possibly cause it to become unfit for use.

Suggested Activities:

1. From the Wildlife and Fisheries Commission, secure a copy of Louisiana's laws concerning pollution of streams and water bodies. Study them to learn what our state is trying to do to make our drainage systems safe for people and other animal life.
2. Visit the nearest water purification system. Learn the processes used to remove any materials suspended in the water supply. Learn also what processes are applied to remove any dissolved material that would make the water unfit for use. Find and study the reports of the State Health Department on analysis of the water as it is distributed from the purification plant.
3. Visit the sewage treatment plant in your community. Learn how the raw sewage is treated to render it harmless before being discharged into a drainage system. Study the principle involved in each stage of the total treatment process. Consider the efficiency of the process by learning the state of purity of the discharge as determined by the Health Department officials. May you be proud of your local sewage disposal equipment, or must you be ashamed of it?
4. Invite an expert plumber to visit the class and to explain how a home septic tank is constructed and the principles of its operation. Under what circumstances would a home need to be equipped with such a device? How efficient are such disposal units, ordinarily?

5. Visit a local industry to learn how any oils, greases, or fats, acids, alkalis, or salts contained in its waste products are neutralized before being discharged into a drainage system.
6. Write an essay summarizing the things you have learned about water pollution or its absence in your community. Include any recommendations for improvement that you would make.

Possible Outcomes:

1. A realization that water pollution can be controlled and corrected if existing laws are observed and rigidly enforced.
2. An understanding of ways in which sewage, factory wastes, and other possible pollutants can be made harmless before being permitted to escape.

9. CONCEPT: IN LOUISIANA, WATER RECREATION IS VERY IMPORTANT TO MANY PEOPLE.

Discussion: Louisiana is peculiarly blessed with bodies of surface water. This has made possible a variety of recreational activities that have developed to massive proportions. A good example of this is the sport fishing business. There are hundreds of lakes in the State. Along the shores of any lake of reasonable size one can find from one to a score or more fishing camps where prospective anglers can rent boats, buy bait, fill coolers with crushed ice, stock up on gasoline and oil for boat motors, and replenish their tackle boxes with artificial lures. Such business has become a major type of commercial activity in the State, and there are doubtless millions of dollars invested in such enterprises. As business is reckoned, these are small but the total is bound to be impressive. Nor does this include the thriving business of operating chartered fishing boats for salt-water fishing from every port along the Gulf in Louisiana. This in itself is considerable.

The rapidly expanding sport of water skiing is another form of recreation on the waters of Louisiana that is growing by leaps and bounds from the standpoint of monetary investment. The cost of high-power boats, skis, and life belts all add up to more than a tidy sum of capital for the enjoyment of thrills obtained from this sport.

Duck hunting, though seasonal, accounts for another major investment in a sports activity that depends on water and water bodies. The amount of money spent by hunters on guns, ammunition, boats, camp rentals, and other needed gear is enormous.

The rental of cottages at fishing and hunting camps represents another source of revenue that increases the money value of water-based recreation. There are hundreds of such lodgings available in all parts of Louisiana.

Swimming has not been so commercialized in the State, but a large proportion of the major motels now provide swimming pools to attract transients. Most public swimming facilities are operated by municipal governments with the income produced offsetting the cost of maintaining the facility with regard to sanitation and safety (life guards).

There can be no question that water-based recreation adds much to the annual economy of Louisiana. This is another good reason for everyone to learn the importance of water and how the supplies of water can be wisely used and protected from pollution

Suggested Activities:

1. Investigate the economic importance of different types of water-oriented recreation in your community, your parish, and the State as a whole. List the business establishments in your community that serve the fishing and hunting public. Do the same for the parish. Assistance can probably be obtained from your local Chamber of Commerce. Obtain from the Sheriff's Office the number of fishing licenses sold annually in your parish. Also, the number of hunting licenses. Learn from your postmaster the number of duck-hunting stamps sold to hunters in your community annually. Inquire of the Wildlife and Fisheries Commission in New Orleans and of the Department of Commerce and Industry in Baton Rouge, concerning the value of investments in hunting and fishing lodges in Louisiana. From one of these it should also be possible to learn the value of sporting equipment bought annually by those who engage in water-oriented forms of recreation. Summarize your findings. Be prepared for some large totals.
2. Every week the news media list cases of drowning. Emphasize again the rules for safety that should be observed in various types of water-oriented recreation.
3. Have the students work in committees to list reasons why recreation is in such immense demand in modern society. Be sure consideration is given to such factors as urbanization, mechanization, leisure time, vacation time, higher income, home environment, early retirement, and tensions developed by modern pressures of the business world.
4. In the light of the findings in Activity No. 1 and No. 3, give some further consideration to the importance of avoiding, controlling, and correcting water pollution in Louisiana.

Possible Outcomes:

1. A thorough understanding of the needs for recreation in modern society.
2. A comprehensive realization of the economic importance of water-oriented recreation in Louisiana.
3. A thorough understanding of the rules of water safety that every one should observe.

10. CONCEPT: PROPER MANAGEMENT IS THE KEY TO SOIL AND WATER CONSERVATION.

Discussion: The conservation of soil and water has been studied at length. Those who have learned most about the ways to use soil and water wisely are referred to as soil scientists. Their recommendations about wise use of these basic resources are called collectively "soil and water management".

Soil scientists stress the fact that different soils are better for different uses, and that each type of soil has several best uses. Using soil for the functions for which it is best adapted is one of their first rules of good soil management. In order to learn the possibilities of use for which soils are well fitted, the scientist would recommend a soil survey. This should show the special capabilities of each soil type as well as its limitations. He would then recommend that for any particular contemplated use a soil type be selected that is by nature adaptable to that purpose. Thus, the ability of the soil should be a factor in deciding whether it should be used for field crops, a garden, a lawn, pasture, orchard, or forest.

Having wisely selected a soil area with suitable capabilities, the scientist would say, treat the soil properly with regard to tillage and supply any mineral nutrients in which tests show it might be deficient if it is expected to yield at maximum rates. He would suggest controlling acidity by use of lime, providing needed minerals through commercial fertilizers and adding organic matter by working in green vegetation. He would also recommend a rotation of cropping that would tend to conserve and restore the nutrients contained in the soil.

Doubtless, the expert would admonish the land owner to try to conserve the rain water that falls on well-drained soil areas and to improve the drainage on places where water tends to remain in too great quantities. In this same connection, it would likely be suggested that, were the natural water supply deficient for the desired use, some means of irrigation be sought that is not too expensive to pay dividends on the investment.

One of the most important things the scientist would include in his recommendations would be the protection of the soil from erosion by wind or water. He would limit the steepness of slopes that could be cultivated and recommend that such areas be used for permanent pasture or forest, or both. He would admonish the land owner to use contour tillage on the gentler slopes and to keep all soil areas covered with winter growing vegetation between cash crops.

In short, the expert in soil management would tell the land owner to have a reason for treating soil, to know the reason and be sure that the treatment is the one needed.

Some consideration should be given the establishment and operation of the Soil and Water Conservation Districts in Louisiana. Acting under an enabling public law enacted earlier by the Congress, the Louisiana legislature passed, in 1938, an act authorizing farmers to set up soil-conservation districts as legal political divisions. By 1949, Louisiana became the first state to have practically all (except Plaquemines Parish) its farm land included in such districts. There are twenty-six districts in the state, each one including an area where soil and water conservation needs are similar, and often ignoring parish lines in their formation. Each is applied for by a petition by twenty-five farmers and a referendum vote of all the land owners within its borders. A two-thirds majority must cast favorable votes for the formation of the district to be effected. Each district is controlled by a board of five supervisors, two of whom are appointed by the State Committee and three elected by the farmers themselves. These districts are actual governmental divisions of the state but are not authorized to levee taxes nor to issue bonds.

Each district plans its own conservation program, and can, and does, seek such assistance as it feels it needs from all available sources. Assistance in a variety of activities and practices is obtained from such organizations as the U. S. Soil Conservation Service, the Agriculture Extension Service, the Agriculture Adjustment Agency, the Louisiana Forestry Commission, the Louisiana Wildlife and Fisheries Commission, and vocational-agriculture teachers.

The organization and operation of these Districts gets nearly all the farmers of Louisiana actively engaged in some or several aspects of soil and water conservation practices that not only add to their individual profit but also serve to renew the soils of our state to a higher level of productivity and promise.

Suggested Activities:

1. Obtain a soils map of Louisiana from either the Soil Conservation Service at Alexandria or the Agriculture Extension Service at L.S.U. Have the students study the map. Learn the type or types of soil to be found in their community and in their parish. Try to find a place where one type of soil borders another type and seek to identify the line of demarcation. Observe differences between the types of soil. Also,

observe the different uses made of the different types of soil. Summarize the learning experiences from the study.

2. Invite a soil scientist to visit the class and to tell the students (1) how a soil survey is made, (2) the different types of soil to be found in the local area and the parish, and (3) the most desirable use that can be made of each type of soil and why. Ask the visitor to recommend the proper kind of treatment for each type of soil in the vicinity to make it yield most profitably. Summarize what is learned from the visit.
3. Obtain from the Soil Conservation agent in your parish a map of the Soil and Water Conservation Districts of Louisiana. Learn which district includes your area. Invite a supervisor of that district to visit the class and tell of the activities being carried out by the district, the sources of assistance the district has been able to procure, and the measure of success that has come about as a result of the district's undertakings. Also, ask him to describe the democratic plan by which the district is governed. Have each student write a summary of the information supplied by the visitor.
4. Have a debate on the subject: "Resolved: that good soil management is a concern and responsibility only of rural residents." Divide the class into committees to help the speakers prepare their arguments. Perhaps the committees should choose representatives to be speakers in the pitched debate. Secure judges from outside the class.
5. Have the students compose statements of generalizations that embody what they have learned about soil and water conservation. Have each student read his efforts to the class. Make a chart of the ten best statements, avoiding repetition of content.
6. Based on the results of No. 4, have a language activity in which each student is asked to write a story or an article for the school or local newspaper involving a summary of what has been learned in the class about soil and water conservation.

Possible Outcomes:

1. An understanding of ways that soil is classified into types and why each type has preferred uses.
2. A realization that soil is a renewable resource.
3. A mature concept of the reasons for soil and water conservation.
4. An understanding of the organization and operation of the Soil and Water Conservation Districts of Louisiana.
5. A conviction that respect for, and conservation of, soil and water is a moral responsibility of every citizen.

GLOSSARY OF TERMS

ACCELERATED:
Caused to go faster; hastened the operation.

ALGAE:
Water plants, often one-celled, that can make their own food.

ALLUVIAL:
Formed by sand or mud deposited by flowing water.

ALKALIES:
Bases or basic compounds that neutralize acids.

ANCHORAGE:
Something to hold on or depend on.

BLOOD PLASMA:
Liquid part of blood, often placed in blood banks for use in transfusion.

BACTERIA:
Very tiny and simple plants, usually seen only through a microscope. Certain bacteria cause disease. Others do useful things.

CAPILLARY ACTION:
A force that is the result of surface tension in liquids which are in contact with solids.

CATASTROPHIC:
Caused by a disaster.

CLAY:
A stiff, sticky kind of earth that can be wet and hardens after drying, smallest grain size.

CLIMATE:
The kind of weather a place has over a period of years.

COASTAL PRAIRIE:
Rolling grasslands near a coast.

CONTAMINATE:
To make impure by contact.

CONSERVATION:
Wise use of things so that there is no waste.

CONTOUR OF THE SLOPE:
Following natural ridges of similar elevation.

CONVERSE:
Opposite.

CULTURE:
Intellectual attainment.

DEPLETION:
Using up.

DREDGING:
Removing mud, sand, and other materials from a river bottom, etc.

ECONOMIC CONDITIONS:
Having to do with the management of income.

ELEMENT:
Simple substance which cannot be further divided.

ENZYMES:
Organic substances produced in cells that cause changes in other substances.

EPIDEMIC:
Widespread.

EROSION:
Wearing away.

EVAPORATION:
Changing into vapor.

EXCRETIONS:
Waste matter eliminated.

EXPLOITATION:
To make unethical use of for one's own benefit.

FERTILITY:
Productivity.

FERTILIZING:
Enriching; making productive.

FUNGI:
Plants that lack chlorophyll such as mildews, molds, rusts, mushrooms, etc.

GEOLOGIC:
Pertaining to the earth's crust and the development of its layers and their history.

GEOLOGIST:
A person who studies the history of the earth's foundation.

GRAVITY:
The natural force that causes objects to move toward the center of the earth.

HARDPAN:
A hard, firm foundation underlying top soil through which water will not go.

HUMUS:
Organic matter in soil which tends to give a darker color and is the principal determiner of the soil's productivity.

HYDROLOGIC CYCLE:
Same as water cycle.

HYDROPONICS:
The growing of plants without soil, by the use of water containing the necessary mineral nutrients.

IMPOUNDING:
Enclosing water with a dam.

IMPERVIOUS:
Not letting things pass through.

INCIPIENT:
Just beginning.

IRRIGATION:
The act of supplying land with water by using ditches, sprinkling, flooding, etc.

LAVA:
Rock formed by the cooling of molten rock flowing from a volcano or crack in the earth.

LEACH:
To dissolve out soluble parts (ashes, ores, etc.) by running water through slowly.

LEGUME:
Plants which take nitrogen from the air and fix it in forms green plants can use. Example: peanuts, soybeans, plants of the pea family, etc.

LICHENS:
Plants that look somewhat like moss and grow in patches on trees, rocks, etc. A lichen consists of a fungus and an alga growing together so that they look like one plant.

LIME:
A white substance, strongly alkaline used on fields to improve the soil.

LIMESTONE:
A rock consisting mostly of calcium carbonate used for building and for making lime.

LOAM:
A mixture of sand, silt, and clay.

MARGINAL:
Barely producing or capable of producing goods, crops, etc. at a rate necessary to cover the costs of production.

MINERALS:
Solid, naturally occurring inorganic substances.

MITOTIC:
Adjective of mitosis, the usual method of cell division which is typically divided into four stages.

NEUTRALIZE:
To counter-balance.

NITROGEN:
A colorless, odorless, tasteless gas that forms about four-fifths of the air by volume. It is one of the most important chemical elements and is a necessary constitutent of all animal and vegetable tissues.

NITROGEN CYCLE:
The circulation of nitrogen and its compounds by living organisms in nature.

NUTRIENT:
A nourishing substance, especially as an element or ingredient of a foodstuff.

ORGANIC:
Objects that are, or were once, living.
Containing carbon (other than as carbonates) as an essential ingredient. This term usually refers to material derived from plant or animal sources.

OSMOSIS:
The diffusion or spreading of fluids through a membrane or partition until they are mixed.

OXYGEN:
A gas without color or odor that forms about one-fifth of the air. Animals and plants cannot live, and fire will not burn, without oxygen.

OXYGEN CYCLE:
The circulation of oxygen.

PARENT MATERIAL:
A type of rock from which soil was derived.

PERCOLATE:
To filter through, or cause a liquid or particles to pass through.

PERMEATE:
To spread through the whole of; pass through; soak through.

POLLUTION:
Uncleanness, defiling.

PRECIPITATION:
The depositing of moisture in the form of rain, hail, snow, sleet, etc.

PROTOPLASM:
Living matter; the substance that is the physical basis of life; the living substance of all plant and animal cells.

RESERVOIR:
A place where water is collected and stored for use, especially an artificial basin created by the damming of a stream.

RESIDUAL:
Left over; resulting from the weathering of rock; remaining in the same place.

ROCK:
Mass or aggregrate of minerals.

Classification:
- a. Igneous - fire formed
- b. Metamorphic - changed
- c. Sedimentary - deposited in layers

RUDIMENTARY:
Undeveloped; in an early stage of development.

SAND:
A material consisting of fine water-worn or disintegrated particles of rocks, finer than gravel.

SANDSTONE:
A sedimentary rock formed by the consolidation of sand, the grains being held together by a cement of silica or the like.

SEPTIC TANKS:
A tank in which sewage is decomposed by anaerobic bacteria.

SCULPTURING:
Cutting on rocks by other rock particles small enough to be carried by the wind.

SHALE:
A fine-grained rock, formed from clay, silt, or mud, that splits easily into thin layers.

SILT:
Very fine particles of earth, etc; soil particles deposited as sediment.

SOIL:
The ground; earth.

SOLUBLE:
That that can be dissolved in water.

SOLUTE:
A solid, gas, or liquid that is dissolved in a liquid to make a solution.

SPILLWAY:
A channel or passage for the escape of surplus water from a dam, terrace, etc.

SUBSISTENCE:
Continued existence; a means of support; livelihood.

SUBSOIL:
The layer of earth that lies just under the top soil.

SYNTHETIC FIBER:
Artificial or man-made fiber.

TRANSPIRE:
To pass off or send off vapor, moisture, etc., through a wall or surface, as from leaves.

TEXTURE:
Quality of soil determined by the size of soil particles.

TERRACE:
A flat, raised piece of land with a vertical or sloping front, or sides, especially any of a series of such levels placed one above the other.

TIDAL MARSH LAND:
Low, wet, soft land over which tides often flow.

TILTH:
Cultivation of land.

TOPOGRAPHY:
The surface features of a region including hills, valleys, rivers, etc.

TOPSOIL:
The upper layer of soil, usually darker and richer than the subsoil.

TRIBUTARIES:
Streams or rivers that flow into larger rivers.

VEGETATIVE COVER:
Thick growth of plants in topsoil.

VITAL:
Necessary to life.

WATER CYCLE:
A cycle whereby water evaporates from oceans, lakes, etc., to form clouds that move over land areas and fall as rain, the runoff largely flowing back to oceans, lakes, etc.

WATERSHED:
The region drained by one river system.

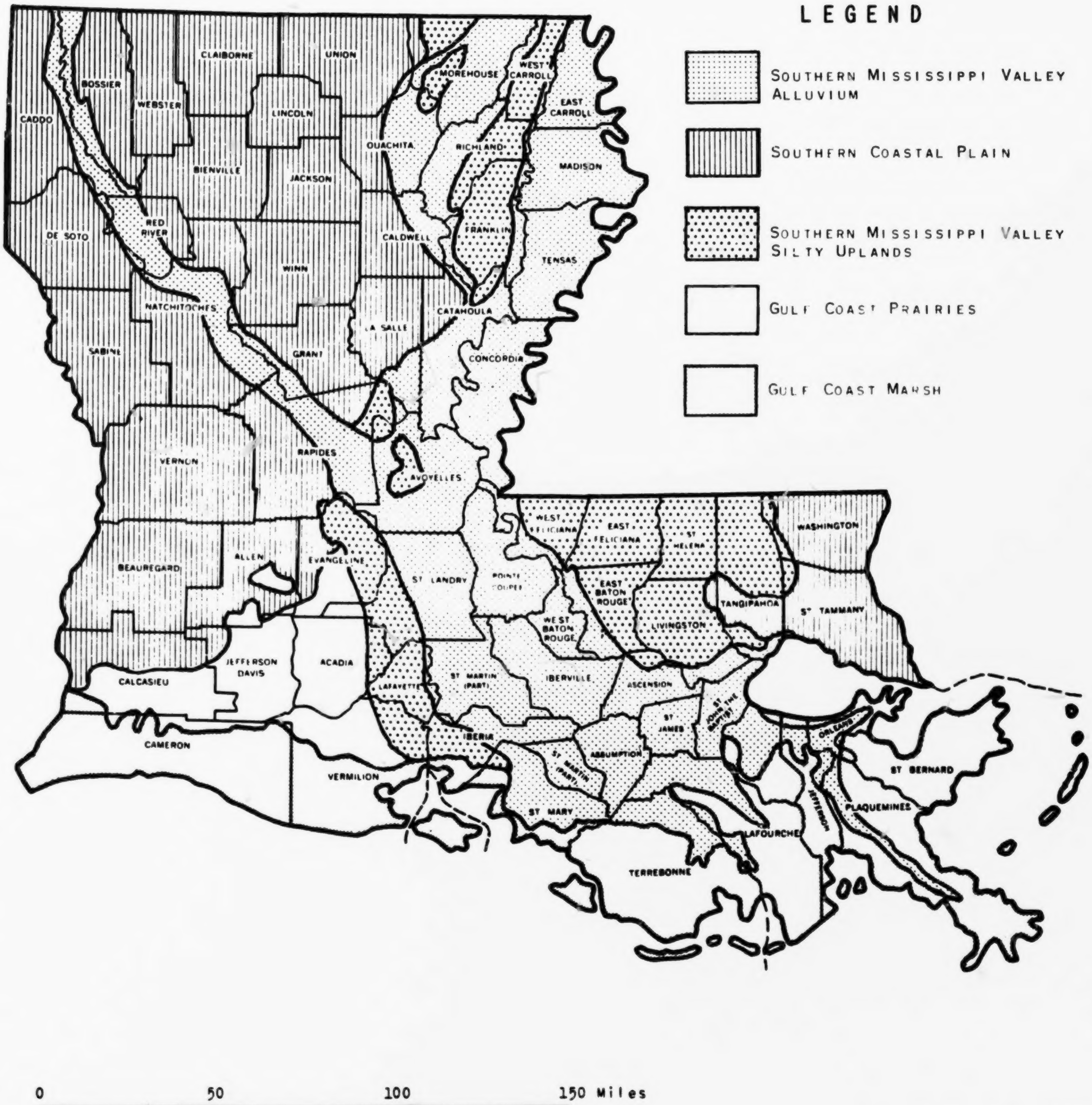
WATER TABLE:
The level at which ground water stands.

WATER VAPOR:
Water in a gaseous state, especially when diffused, as in air, and below the temperature of boiling, as contrasted with steam.

WEATHERING:
Combined action of moisture, temperature, and wind, including the extreme changes in all of them.

APPENDIX I

MAJOR LAND RESOURCE AREAS
LOUISIANA


LEGEND
Southern Mississippi Valley Alluvium
Southern Coastal Plain
Southern Mississippi Valley Silty Uplands
Gulf Coast Prairies
Gulf Coast Marsh
CADDO
BOSSIER
WEBSTER
CLAIBORNE
UNION
LINCOLN
MOREHOUSE
WEST CARROLL
EAST CARROLL
OUACHITA
RICHLAND
MADISON
BIENVILLE
JACKSON
RED RIVER
DE SOTO
WINN
CALDWELL
FRANKLIN
TENSAS
NATCHITOCHES
LA SALLE
CATAHOULA
SABINE
GRANT
CONCORDIA
VERNON
RAPIDES
AVOYELLES
BEAUREGARD
ALLEN
EVANGELINE
ST LANDRY
POINTE COUPEE
WEST FELICIANA
EAST FELICIANA
ST HELENA
WASHINGTON
EAST BATON ROUGE
WEST BATON ROUGE
LIVINGSTON
TANGIPAHOA
ST TAMMANY
CALCASIEU
JEFFERSON DAVIS
ACADIA
LAFAYETTE
ST MARTIN (PART)
IBERVILLE
ASCENSION
ST JAMES
ST JOHN THE BAPTIST
ORLEANS
ST BERNARD
CAMERON
VERMILION
IBERIA
ST MARTIN (PART)
ASSUMPTION
ST MARY
LAFOURCHE
JEFFERSON
PLAQUEMINES
TERREBONNE
0
50
100
150 Miles

Rev. 12-67 4-L-19104

U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Alexandria, Louisiana

Base 4-L-15779A

MAJOR LAND RESOURCE AREAS

The Southern Mississippi Valley Alluvium includes the level bottomland along the Mississippi, Red, and Ouachita rivers. There are many swamps in the southern part.

The soils are fertile and productive. Most of them need ditches to improve drainage for cropland or pasture. Flooding occurs in some places.

Cotton, corn, soybeans, sugarcane, and pasture are the main crops where drainage is adequate. Trees usually grow on undrained areas. The land's value is high for cultivated crops and pasture. Because of this, forest land is being cleared at a rapid rate.

Sharkey clay and Commerce silt loam are major soils in the Mississippi river bottomland. Miller clay and Norwood silt loam are major soils along the Red river. Perry clay and Hebert silt loam are the major soils along the Ouachita and Boeuf rivers.

The Southern Coastal Plain includes the rolling hills of northern and western Louisiana and the eastern part of the Florida Parishes. Nearly level areas in Allen, Beauregard, Calcasieu, and St. Tammany Parishes are referred to as "flatwoods".

In many places the early settlers cleared this land to grow crops but because of low yields it is now used mainly for woodland. Small amounts are still used for cropland and pasture.

Soil fertility is low. Natural soil drainage is good in most places. The soils erode easily when used for cultivation crops.

Roswell, Shubuta, and Ruston fine sandy loams are major soils in the sloping areas. Caddo and Beauregard silt loams are dominant in the nearly level "flatwoods".

The Southern Mississippi Valley Silty Uplands include the nearly level stream terraces and rolling upland areas that border the Mississippi river bottomland. Cotton, corn, truck crops, pasture and woodland are the principal land uses. The soils are moderately productive. Drainage or erosion control is used to improve crop yields.

Grenada, Calloway, Calhoun, and Olivier silt loams are major soils.

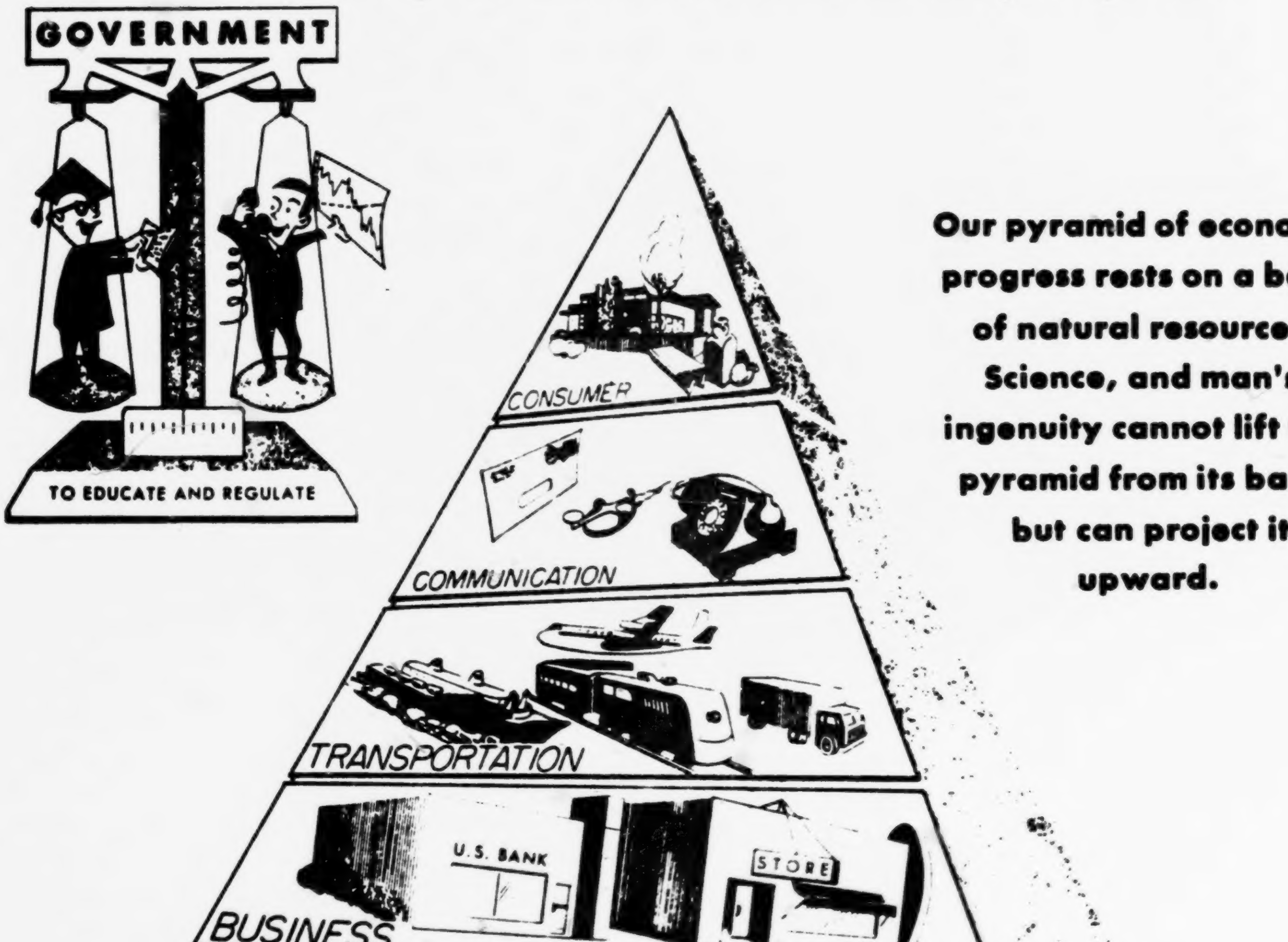
The Gulf Coast Prairies include the nearly level, poorly drained portion of Southwest Louisiana. Rice, soybeans, and pasture are major crops. The native vegetation was prairie grasses and there are only a few trees in this area. Drainage and irrigation are important conservation practices. Fertility level is moderate. Crowley silt loam and Midland silty clay loam are dominant soil types.

The Gulf Coast Marsh borders the Gulf of Mexico. About 1/2 is freshwater marsh and the remainder is salt-water marsh that is affected by daily tides. A few sandy ridges in this area are called cheniers. Soils that are firm enough for cattle to walk on are used for range. Wildlife is abundant.

APPENDIX II

NATURAL RESOURCES

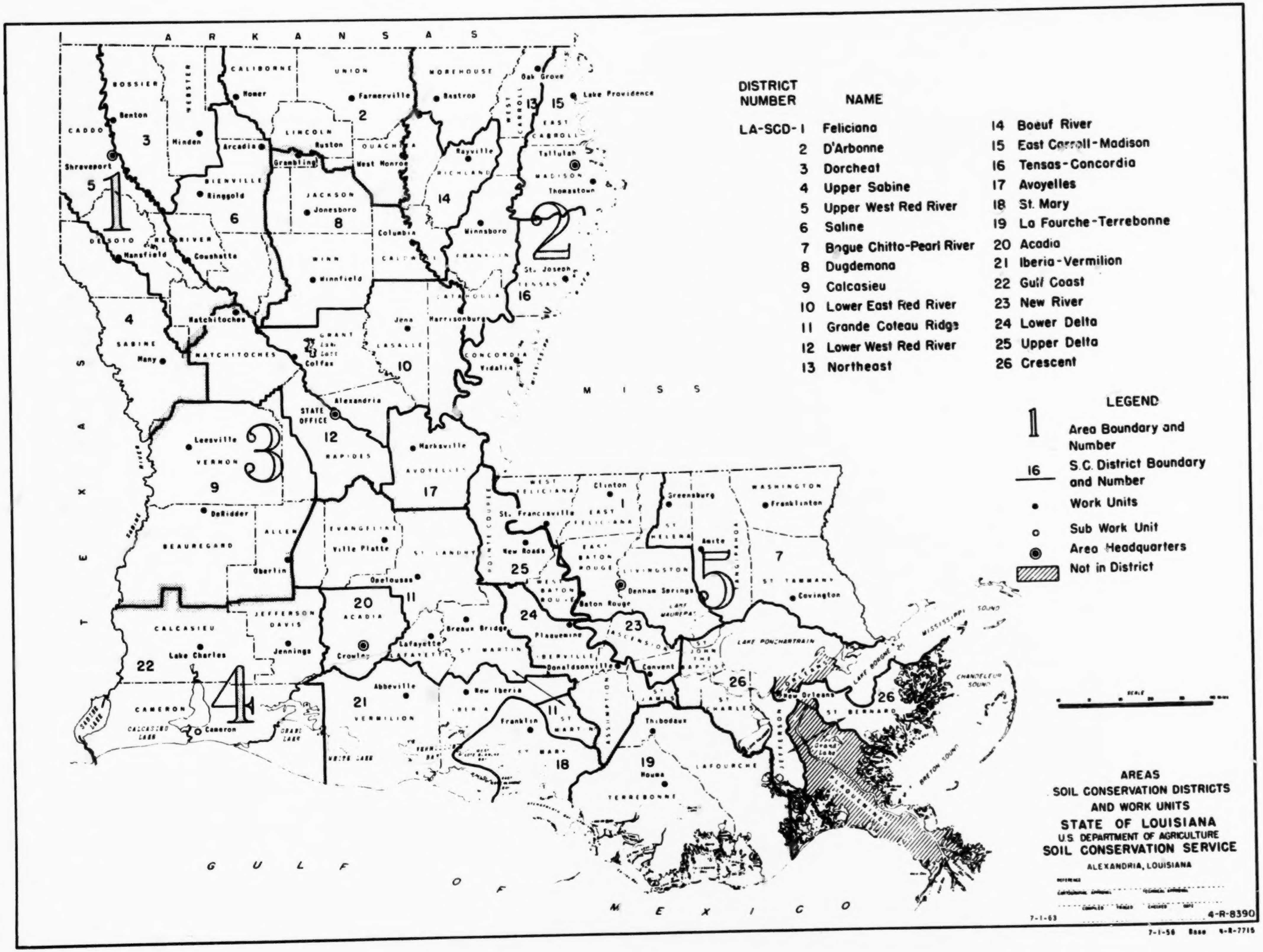
The base of our existence and the measure of our future


GOVERNMENT
TO EDUCATE AND REGULATE
CONSUMER
COMMUNICATION
TRANSPORTATION
U.S. BANK
STORE
BUSINESS
INDUSTRY
AGRICULTURE
WOOD-LANDS
WILD-LIFE
SOIL
WATER
MINERALS
SUNSHINE
AND OTHER NATURAL RESOURCES

Our pyramid of economic progress rests on a base of natural resources. Science, and man's ingenuity cannot lift this pyramid from its base, but can project it upward.

Practice and Promote Conservation

APPENDIX III



A R K A N S A S
T E X A S
M I S S
G U L F O F M E X I C O
CADDO
BOSSIER
WEBSTER
CLAIBORNE
UNION
MOREHOUSE
WEST CARROLL
EAST CARROLL
LINCOLN
OUACHITA
RICHLAND
MADISON
BIENVILLE
JACKSON
DE SOTO
RED RIVER
WINN
CALDWELL
FRANKLIN
TENSAS
SABINE
NATCHITOCHES
GRANT
LA SALLE
CATAHOULA
CONCORDIA
VERNON
RAPIDES
AVOYELLES
BEAUREGARD
ALLEN
EVANGELINE
ST. LANDRY
POINTE COUPEE
WEST FELICIANA
EAST FELICIANA
ST. HELENA
TANGIPAHOA
WASHINGTON
ST. TAMMANY
EAST BATON ROUGE
WEST BATON ROUGE
LIVINGSTON
CALCASIEU
JEFFERSON DAVIS
ACADIA
LAFAYETTE
ST. MARTIN
IBERVILLE
ASCENSION
ST. JOHN
ST. JAMES
ST. CHARLES
ASSUMPTION
CAMERON
VERMILION
IBERIA
ST. MARY
LAFOURCHE
TERREBONNE
JEFFERSON
ORLEANS
ST. BERNARD
PLAQUEMINES
Shreveport
Benton
Minden
Homer
Arcadia
Ruston
Grambling
Farmerville
West Monroe
Bastrop
Oak Grove
Lake Providence
Tallulah
Thomastown
Rayville
Winnsboro
Columbia
Ringgold
Jonesboro
Mansfield
Coushatta
Winnfield
Natchitoches
Many
Colfax
Jena
Harrisonburg
St. Joseph
Vidalia
Alexandria
STATE OFFICE
Leesville
DeRidder
Oberlin
Marksville
Ville Platte
Opelousas
New Roads
St. Francisville
Clinton
Greensburg
Amite
Franklinton
Covington
Denham Springs
Baton Rouge
Plaquemine
Donaldsonville
Convent
Breaux Bridge
Lafayette
Crowley
Jennings
Lake Charles
Cameron
Abbeville
New Iberia
Franklin
Thibodaux
Houma
New Orleans
LAKE PONCHARTRAIN
LAKE MAUREPAS
LAKE BORGNE
MISSISSIPPI SOUND
CHANDELEUR SOUND
BRETON SOUND
CALCASIEU LAKE
GRAND LAKE
WHITE LAKE
SABINE LAKE
SABINE RIVER
1
2
3
4
5
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
SCALE
LEGEND
1 Area Boundary and Number
16 S.C. District Boundary and Number
● Work Units
○ Sub Work Unit
◉ Area Headquarters
▨ Not in District

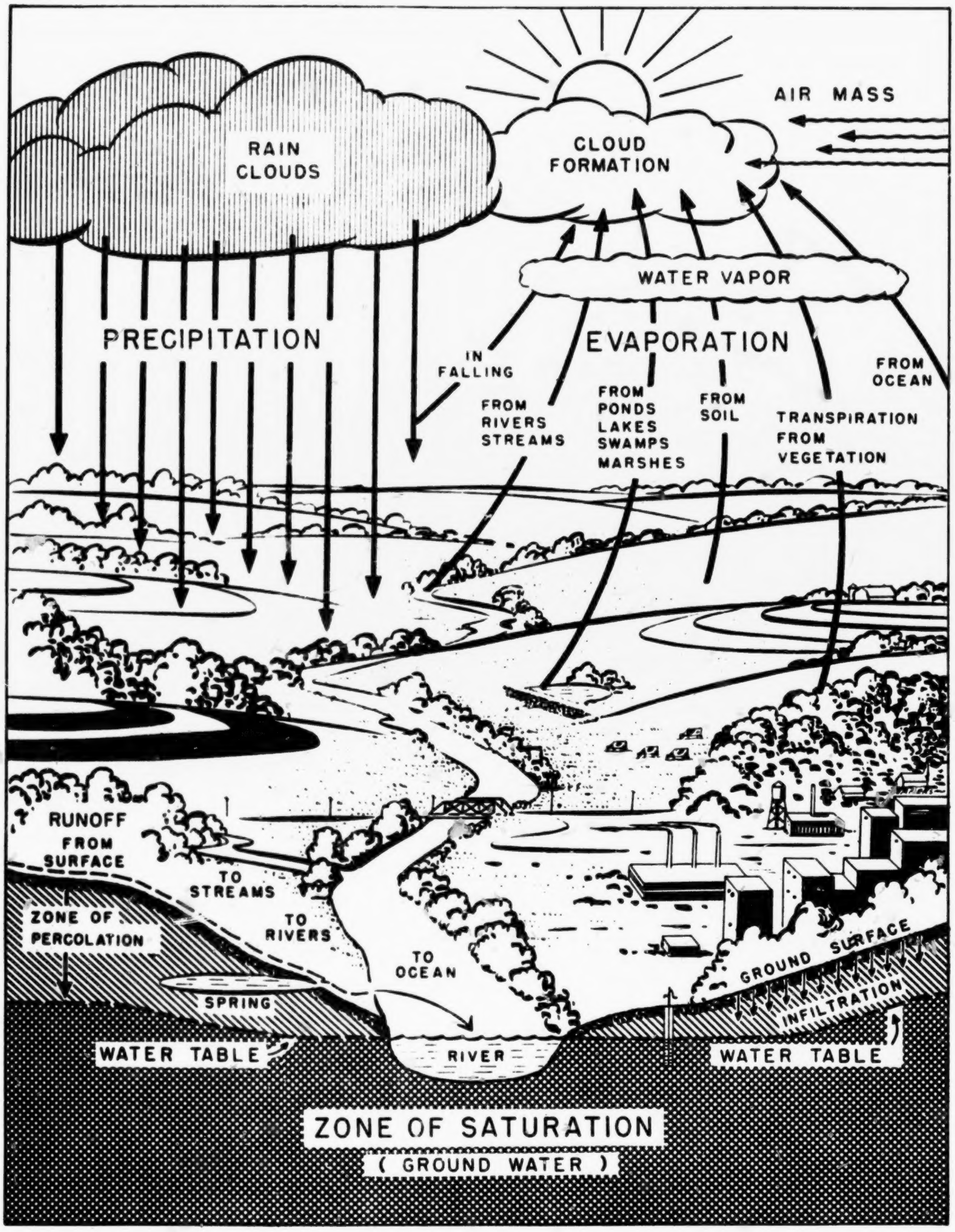
DISTRICT NUMBER	NAME		
LA-SCD-1	Feliciana	14	Boeuf River
2	D'Arbonne	15	East Carroll-Madison
3	Dorcheat	16	Tensas-Concordia
4	Upper Sabine	17	Avoyelles
5	Upper West Red River	18	St. Mary
6	Saline	19	La Fourche-Terrebonne
7	Bogue Chitto-Pearl River	20	Acadia
8	Dugdemona	21	Iberia-Vermilion
9	Calcasieu	22	Gulf Coast
10	Lower East Red River	23	New River
11	Grande Coteau Ridge	24	Lower Delta
12	Lower West Red River	25	Upper Delta
13	Northeast	26	Crescent

AREAS
SOIL CONSERVATION DISTRICTS
AND WORK UNITS
STATE OF LOUISIANA
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
ALEXANDRIA, LOUISIANA

7-1-63 4-R-8390
7-1-56 Base 4-R-7715

APPENDIX IV

Where Your Water Comes From


AIR MASS
RAIN CLOUDS
CLOUD FORMATION
WATER VAPOR
PRECIPITATION
EVAPORATION
IN FALLING
FROM RIVERS STREAMS
FROM PONDS LAKES SWAMPS MARSHES
FROM SOIL
TRANSPIRATION FROM VEGETATION
FROM OCEAN
RUNOFF FROM SURFACE
TO STREAMS
TO RIVERS
TO OCEAN
ZONE OF PERCOLATION
SPRING
WATER TABLE
RIVER
GROUND SURFACE
INFILTRATION
WATER TABLE
ZONE OF SATURATION
(GROUND WATER)

The State of Louisiana has an average rainfall of 56 inches annually.

About 98% of our precipitation falls on the land. Landowners, therefore, control to an important degree the movement of water that falls on their land.

Conservation, development, management, and use of water through watershed protection, flood prevention, and agricultural water management is high priority business in Louisiana.

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APPENDIX V

THE AMERICAN SONG OF THE SOIL

Published by
RADIO STATION KXLY
Spokane, Washington

Words by
WALTER A. GROOM
Soil Conservation Farmer
Grand Junction, Colo.

Music by
DEL YANDON, KXLY
Spokane, Wash.

Sing this song at soil conservation meetings, in schools, in Granges, sing it everywhere to further the cause of conservation.

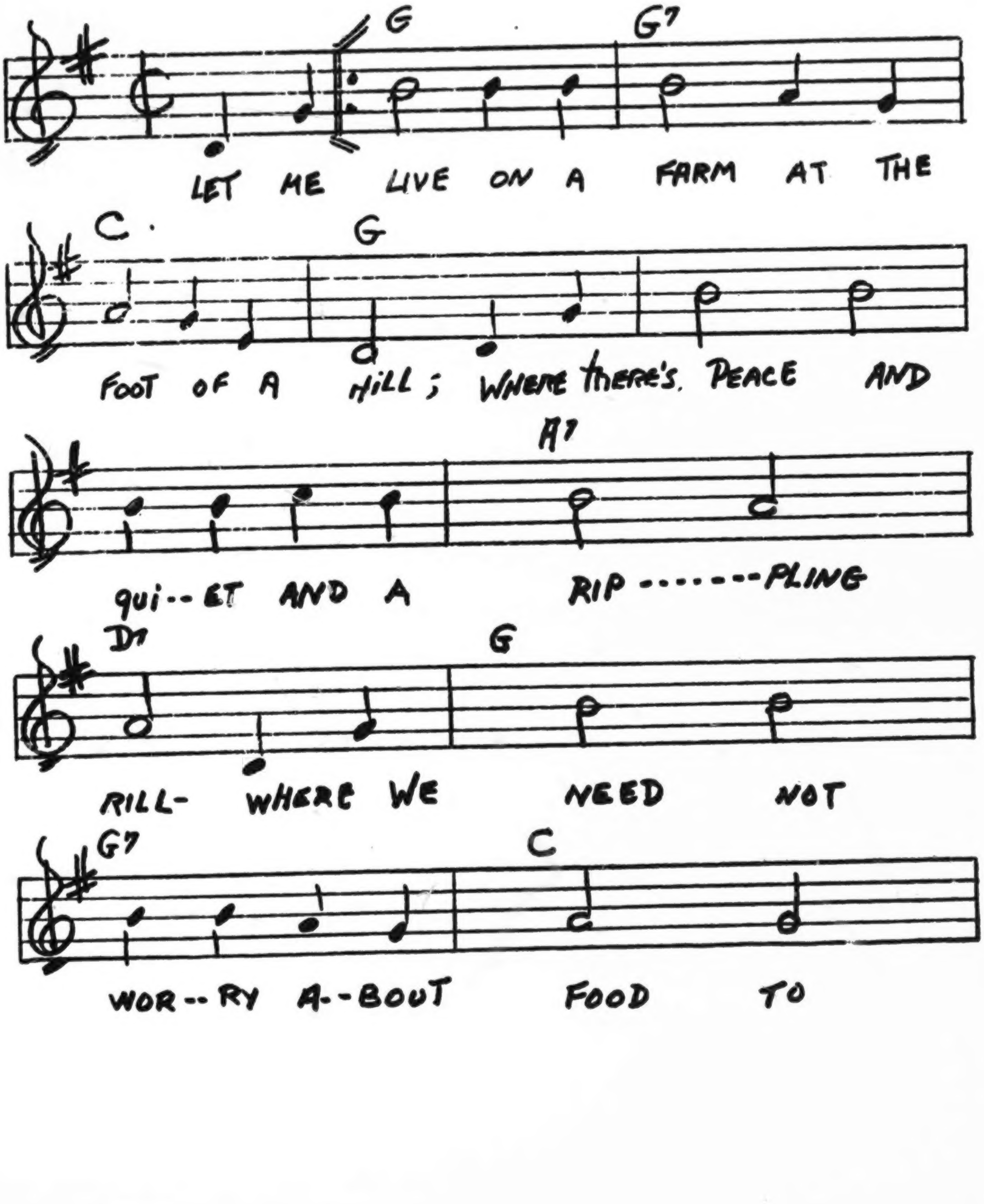
The Story

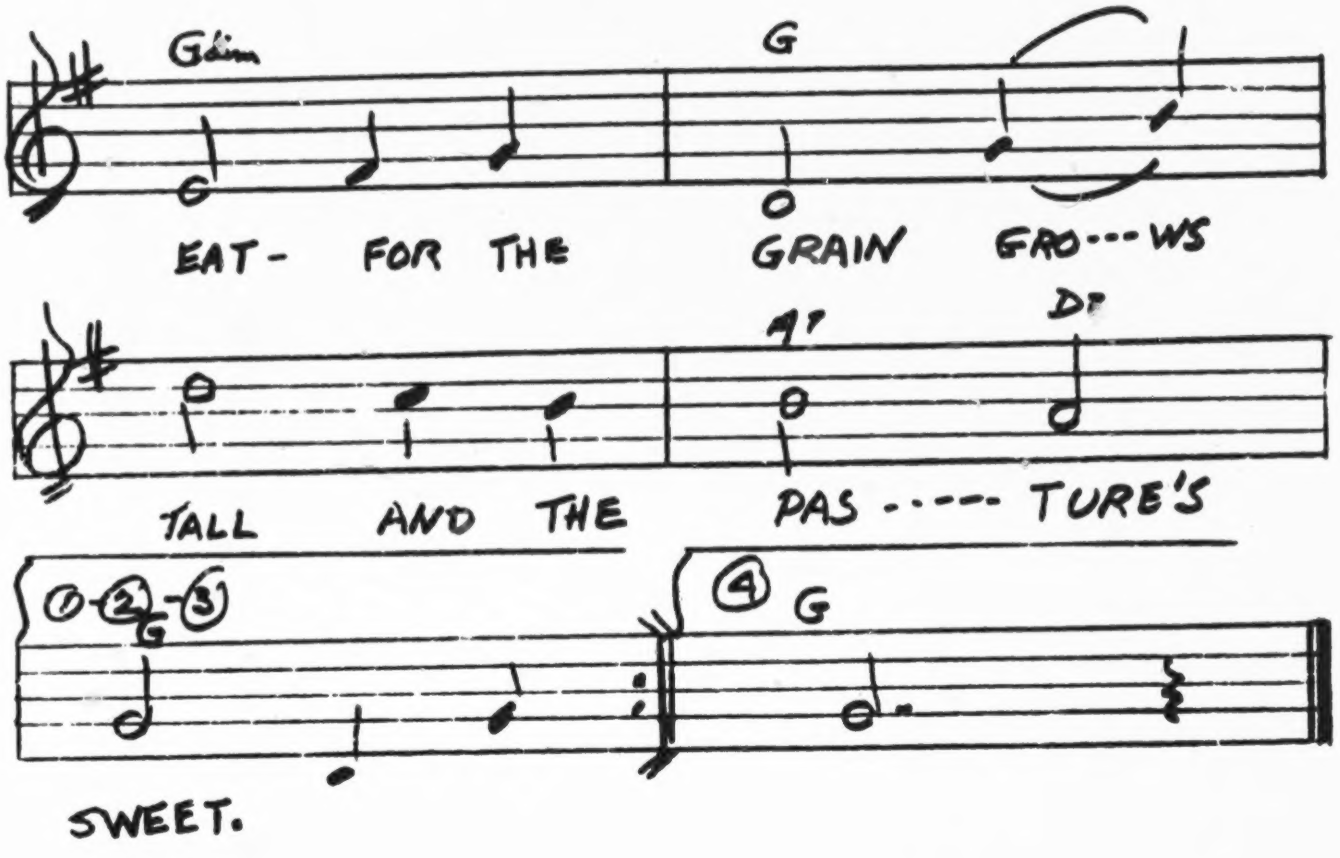
Walter A. Groom, author of the words of the American Song of The Soil, is a practical, conservation farmer living at Grand Junction, Colorado. He has always taken active part in the soil conservation movement, and the inspiration to write a poem about the land came to him during the year 1941, when he was president of the Colorado Association of Soil Conservation districts. The verses told the story of conservation so vividly that W. B. Russell, soil conservationist of Kootenai County, Idaho, made typewritten copies and sent them out to his agricultural friends. A copy was also sent to Ernie Jorgenson, Farm Editor, KXLY, who suggested that Clyde and Pal, Hillbilly singers, set the words to music. Composer Del Yandon was called to assist and the song was written and presented for the first time on the air by Clyde and Pal, March 9, 1950. The song has been dedicated to the conservation farmers of America and copyright has been applied for in order to make it public domain. Free copies of "At The Foot Of A Hill" will be given to farmers, schools, granges, etc., who apply to the publishers, KXLY, Spokane 8, Washington.

"AT THE FOOT OF A HILL"

LYRICS BY
WALTER A. GROOM

MUSIC BY
DEL YANDON
KXLY


G
G7
LET ME LIVE ON A FARM AT THE
C
G
FOOT OF A HILL; WHERE THERE'S PEACE AND
A7
QUI--ET AND A RIP-------PLING
D7
G
RILL- WHERE WE NEED NOT
G7
C
WOR--RY A--BOUT FOOD TO


Gdim
G
EAT- FOR THE GRAIN GRO---WS
A7
D7
TALL AND THE PAS----TURE'S
①-②-③
G
④ G
SWEET.

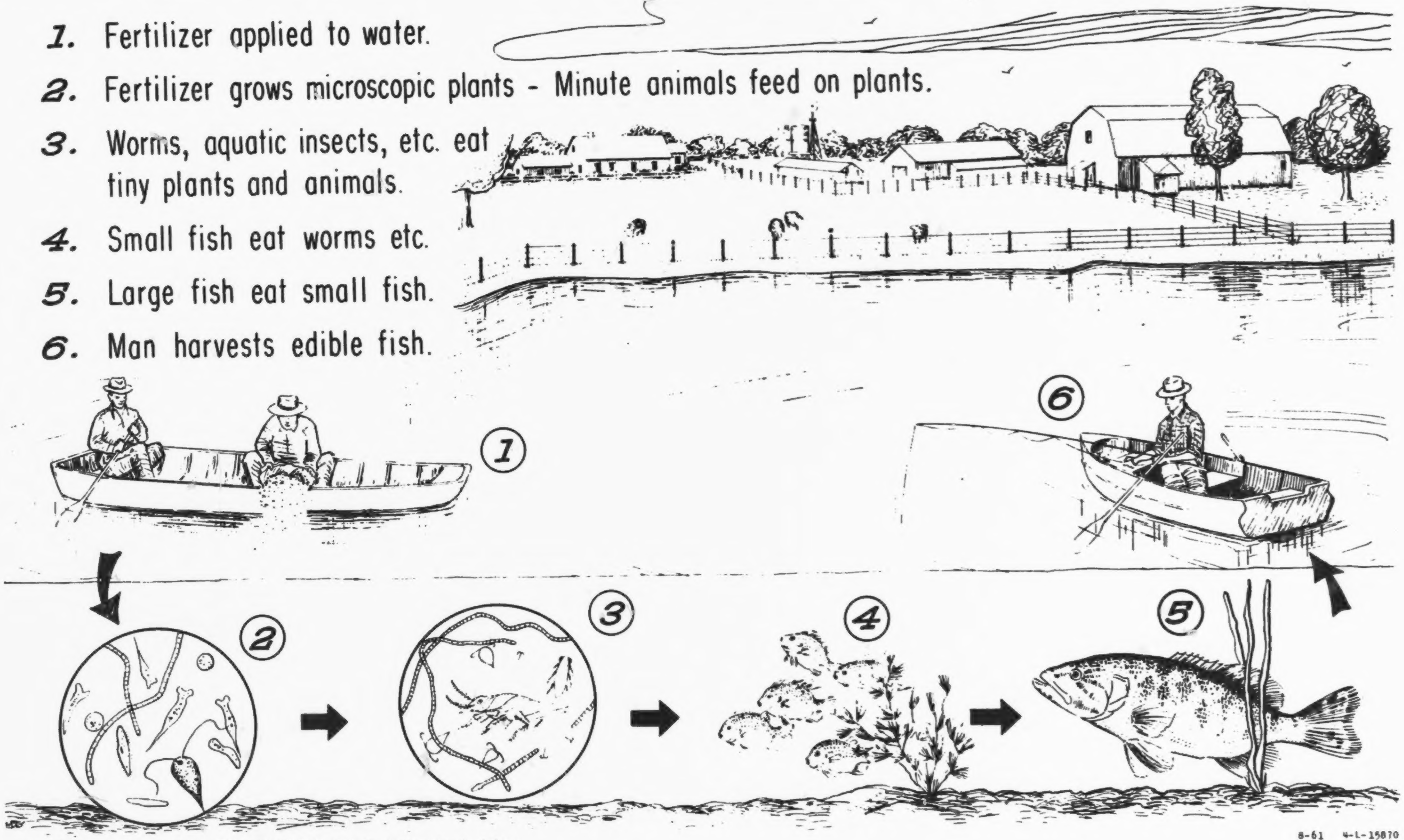
A WONDERFUL PLACE FOR A FARM AND A HOME
WHERE THE STREAMS RUN CLEAR FROM THE FOREST LOAM:
WHERE THERE'S PLENTY OF GRASS FOR THE COWS AND DEER,
FOR CONSERVATION IS PRACTICED HERE.

LET ME LIVE ON A FARM AT THE FOOT OF A HILL,
WHERE MANKIND WATCHES AS HE ALWAYS WILL,
THE HARVEST REAPED FROM A WELL-PLANNED FARM
WHERE THE SOIL IS SAFE FROM EROSION'S HARM.

LET ME LIVE ON A FARM AT THE FOOT OF A HILL,
WHERE THERE'S PEACE AND QUIET AND A RIPPLING RILL:
WHERE THE SOIL'S NAILED DOWN WITH A BLANKET OF SOD---
A PLEASANT SIGHT IN THE EYES OF GOD.

CHAIN OF EVENTS IN A FARM FISH POND

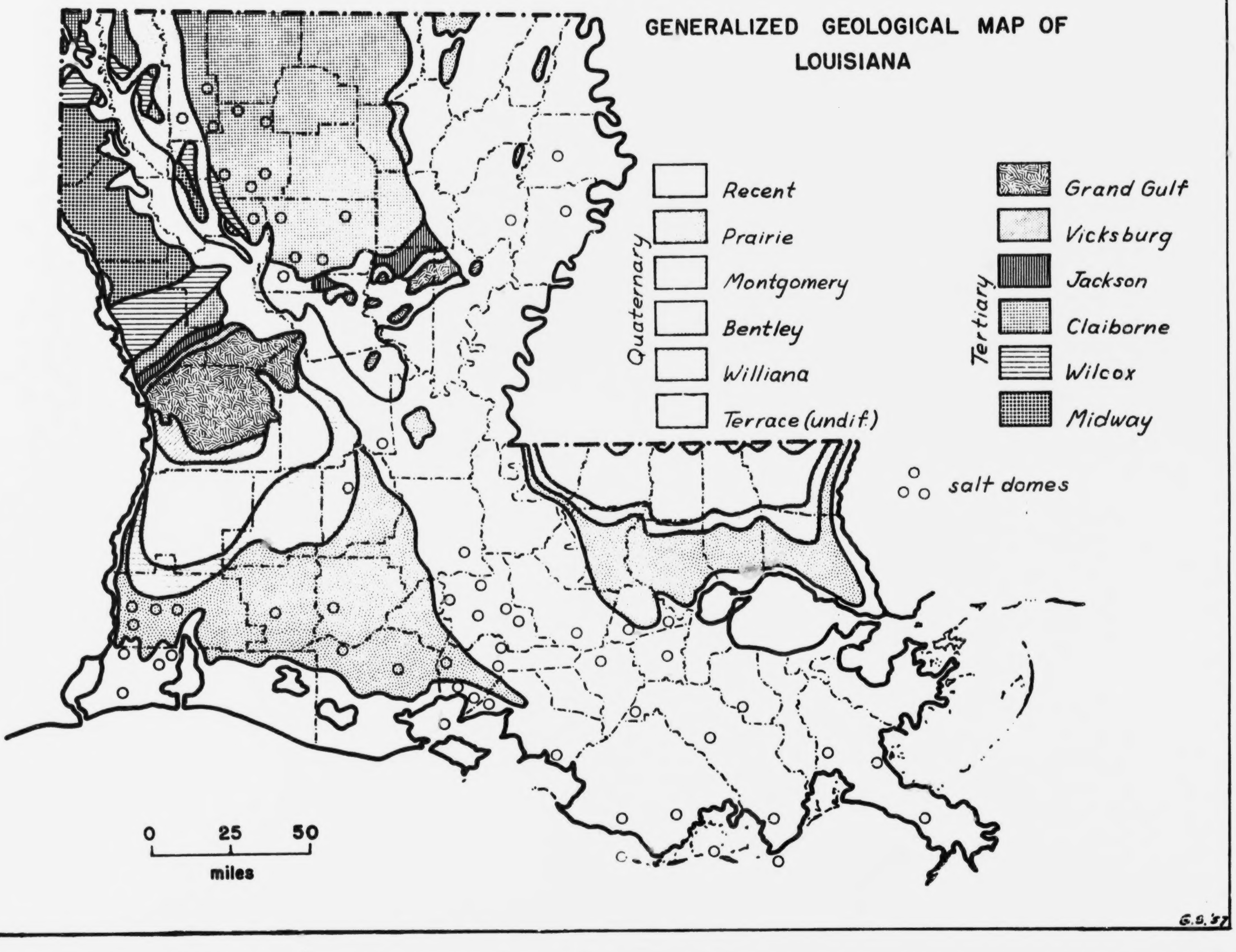
1. Fertilizer applied to water.
2. Fertilizer grows microscopic plants - Minute animals feed on plants.
3. Worms, aquatic insects, etc. eat tiny plants and animals.
4. Small fish eat worms etc.
5. Large fish eat small fish.
6. Man harvests edible fish.



U. S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, Alexandria, Louisiana

8-61 4-L-15870

GENERALIZED GEOLOGICAL MAP OF LOUISIANA


Quaternary
Recent
Prairie
Montgomery
Bentley
Williana
Terrace (undif.)
Tertiary
Grand Gulf
Vicksburg
Jackson
Claiborne
Wilcox
Midway
salt domes
0
25
50
miles
G.S.'37

Conservation Pledge

I GIVE MY
PLEDGE AS AN AMERICAN
TO SAVE AND FAITHFULLY TO
DEFEND FROM WASTE THE
NATURAL RESOURCES OF
MY COUNTRY — ITS SOIL
AND MINERALS, ITS
FORESTS, WATERS,
AND WILDLIFE